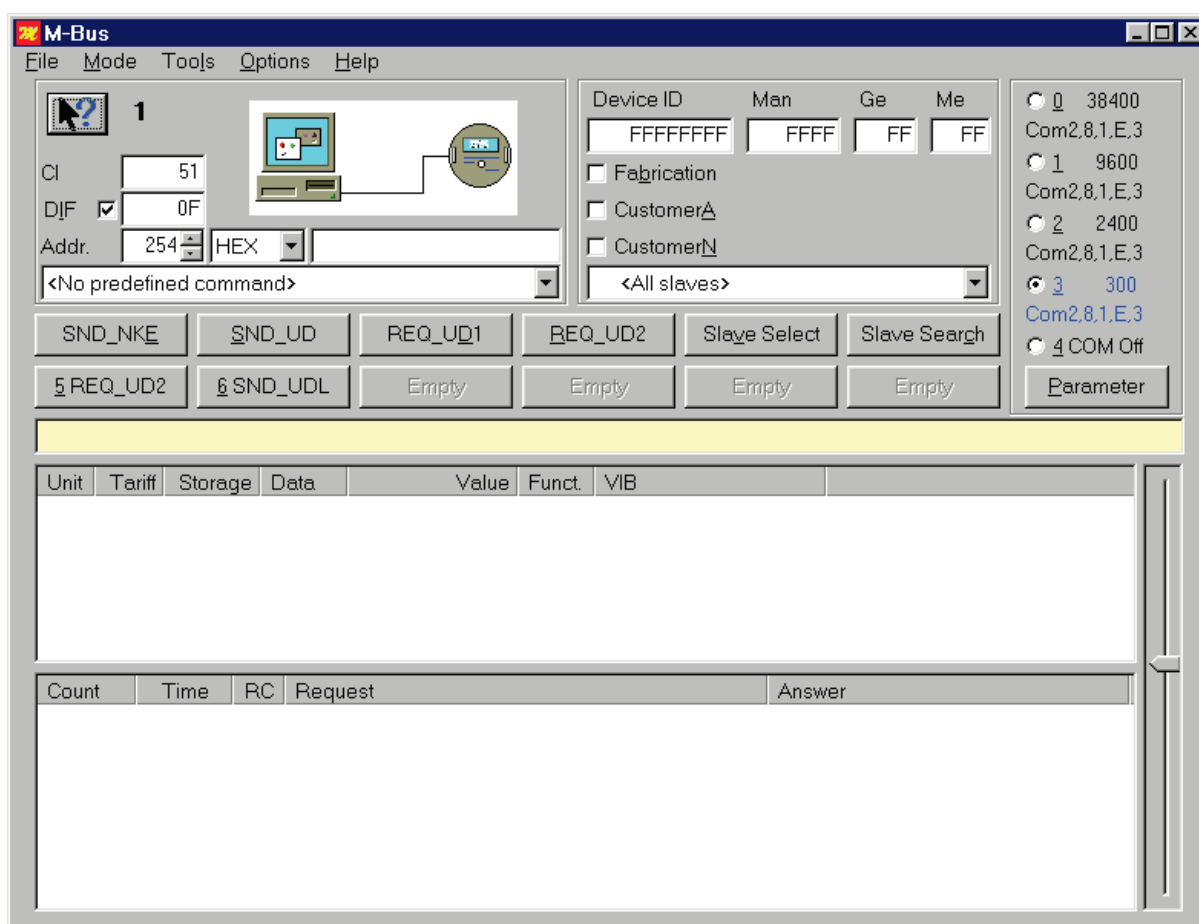


# M-Bus Application

## Version: 1.29



**User Manual (English)**  
**Version: 1.29 (June 2012)**

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# 1 Introduction

Welcome to *M-Bus Application*, a program capable of doing most anything regarding the *Meter-Bus* (M-Bus). The M-Bus is a low-cost bus system used for reading consumption meter devices such as watermeter, heatmeter, electricitymeter and much more. It was developed by Prof. Ziegler of the University of Paderborn together with Texas Instruments and Techem. For all meters except electricitymeters it has become an european standard.

To understand this manual and the program you should be familiar with the main features of the M-Bus. Especially useful are 'The M-Bus, A Documentation' and other documents found at the official M-Bus web-site (<http://www.m-bus.com>).

## 1.1 Installation and De-Installation

For installing *M-Bus Application* do the following steps:

1. Insert the *M-Bus Application* installation CD-ROM into your CD-ROM drive.
2. If the autostart feature is enabled the installation program starts immediately. If not, you have to execute *MBSETUP.EXE* in the top-level directory of the CD-ROM (e.g. from the Task-Bar press: *Start->Execute* and type 'd:\mbsetup.exe', replace 'd:' with the drivename of your CD-ROM).
3. Choose the installation path and press *Next*.
4. Choose whether you want to install *M-Bus Application* with english or german help files (the program itself is only available in English) and press *Next*.
5. Press *Finish* to exit the installation.
6. To execute *M-Bus Application* press *Start->Programs* from the Task-Bar and select *M-Bus Application*.

For de-installing *M-Bus Application* do the following steps:

1. From the Task-Bar press *Start->Settings->Control Panel* and execute *Software*.
2. Select *M-Bus Application* from the upcoming list and press *Add/Remove*.
3. Confirm the de-installation of *M-Bus Application*.
4. After the de-installation program has finished press *OK*.
5. All *M-Bus Application* related files and registry entries are now removed from your system.


## 1.2 Manuals

This document (in english and german) is also available on the installation CD-ROM. It will not be copied to your harddisk during installation. The following documents are available (replace 'd:' with the drive name of your CD-ROM):

- 'd:\docu\english\MBusApp.pdf'                      english manual in Acrobat Reader Format
- 'd:\docu\german\MBusApp.pdf'                      german manual in Acrobat Reader Format

## 1.3 Using the Program

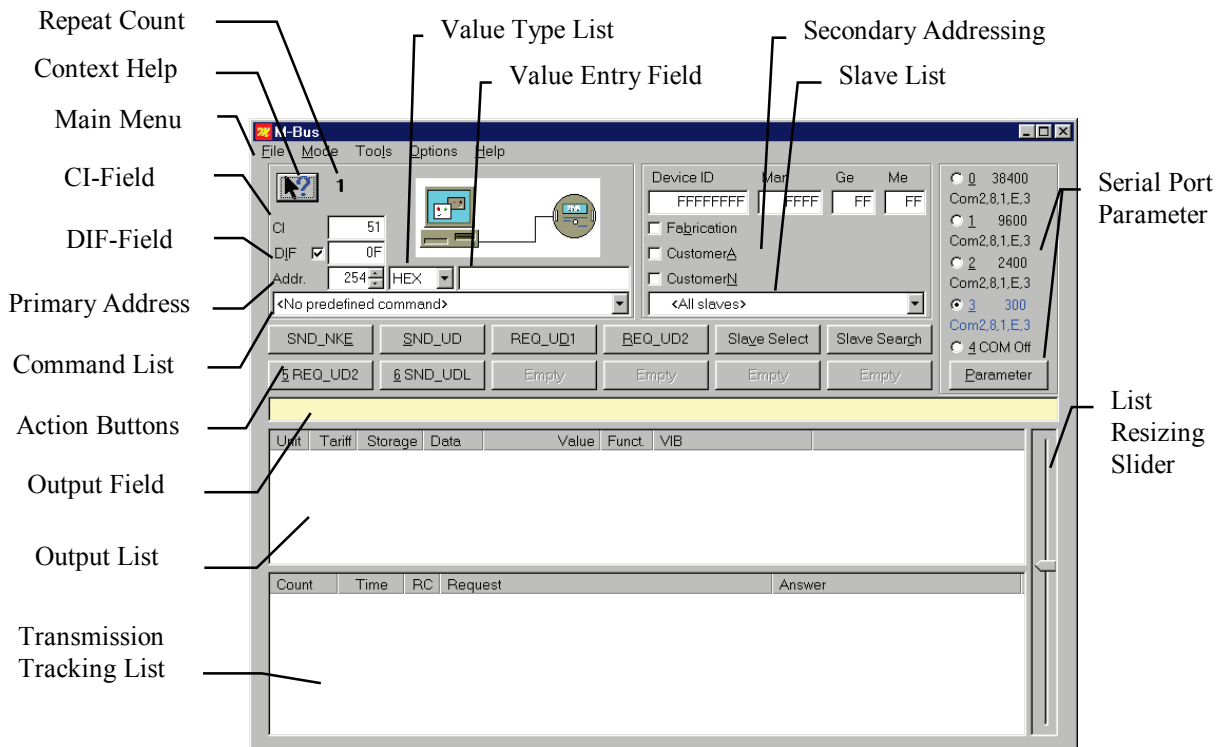
*M-Bus Application* is a native 32-bit Windows 95/98/NT© program. The usage is similar to all other standard Windows© programs. However, here are some tips:

- *M-Bus Application* has a context-sensitive help-system. Whenever you want to know what a certain button or item does, look for the context help button . Press this button and you will see how the cursor shape is changed. Press the button or item you want to know more about and a help window will appear. In some dialogs there is no context help button but a standard help button.
- All lists and some other items in *M-Bus Application* have context menus. Single-click with the right mouse button somewhere on the list and a context menu will appear.
- The contents of all lists in *M-Bus Application* can easily be exported into the clipboard or directly to Microsoft Excel©. Select the appropriate option from the context menu of the list.
- Select list entries by single-clicking the entries first column. Select more than one entry by using the CTRL and ALT keys.
- Entry fields with a yellow background are read-only.

## 2 Functional Description

A picture of the main window after installation is shown below. You may resize or maximize the window to enlarge the *output list* and the *transmission tracking list*. In this chapter the elements of the main screen are described in detail.

### 2.1 Main Window




A screenshot of the main window after installation and execution of *M-Bus Application* is shown above. There are mainly seven different sections. These sections are described in detail in the next chapters:

- Main Menu (see 2.2)
- Data Input Section (upper left section, including *CI-Field*, *DIF-Field*, *Primary Address*, ..., see 2.1.1)
- Secondary Addressing Section (upper middle section, including *Slave List*, ..., see 2.1.2)
- Serial Port Section (upper right section, see 2.1.3, 2.2.3.5)
- Action Buttons (middle, see 2.1.4)
- Output Section (lower middle, including *Output Field* and *Output List*, see 2.1.5)
- *Transmission Tracking List* (bottom, see 2.1.6)

#### 2.1.1 Data Input Section

The *Data Input Section* contains the following elements:

- **Context Help Button**  : Whenever you want to know what a certain button or item does, press the context help button and see how the cursor shape is changed to a question-mark. Press any button or item and the upcoming help window will give you more information about it.
- **Repeat Count**: The number of retries for one M-Bus request. During a M-Bus communication this number is counted up for each failed transfer. You can set the maximum number of retries for one M-Bus request using the dialog (see 2.2.3.5). The default is 3 retries per M-Bus request.
- **Picture**: The picture shows an ongoing transmission by a moving 'M'. Whether the 'M' moves from the computer to the meter or vice versa the data is transmitted from master to slave or vice versa.
- **CI-Field**: The *CI-Field* is only used in conjunction with a SND\_UD request (see 2.1.4). The entry is interpreted as one HEX-byte and used as *Control Information-field* in the telegram. The default for a

SND\_UD is 51 (hexadecimal). The *CI-Field* is not used in conjunction with a *Slave Selection* telegram (see 2.1.4). A slave selection is always done with CI = 52.

- **DIF-Field:** This entry may contain the first byte of the first data record to send with a SND\_UD. Usually this field is not needed because a complete data record (including the DIF) is entered in the *Value Entry Field*. Therefore, uncheck the box on the left handside of the entry field. However, if you want to send manufacturer specific data which are coded as ASCII-characters you may want to enable the *DIF-Field* and enter 0F (hexadecimal, = manufacturer specific data following) because you are not able to enter 0F (hexadecimal) using ASCII-characters.
- **Primary Address:** Contains the primary M-Bus address of the telegram to send. Valid addresses range from 0 to 255. The address is automatically changed to 253 if you have used the *Slave Selection* button (see 2.1.4).
- **Value Type List:** The *Value Type List* gives the interpretation of the *Value Entry Field* (see below). Possible options are:
  - **HEX:** All entered characters are interpreted as hexadecimal values (e.g. '0A FE 34'). Any non-hexadecimal characters are ignored.
  - **ASC:** All entered characters are used 'as they are' (ASCII-characters)
  - **D+T:** A date and time entry is expected (e.g. '01.01.1998 12:00')
  - **DAT:** A date entry is expected (e.g. '01.01.1998')
  - **Ix:** All entered characters are interpreted as one integer value. If the length of the entry is longer or shorter than the chosen integer accuracy the value is extended or truncated.
  - **Bx:** All entered characters are interpreted as one BCD value. If the length of the entry is longer or shorter than the chosen BCD accuracy the value is extended or truncated.
  - **R4:** All entered characters are interpreted as one four byte real value. The entered value is extended or truncated to fit in a four byte real number.
- **Value Entry Field:** The *Value Entry Field* is used together with a SND\_UD request. Depending on the *Value Type List* you can enter a complete data record (DIB+VIB+value) as HEX-bytes or enter manufacturer specific data (e.g. as ASCII-character) which should be send with the next SND\_UD request. If you have defined M-Bus commands you may want to enter integer or BCD values.
- **Command List:** In *M-Bus Application* you are able to predefine data records which can be send in a SND\_UD request (see 2.2.2.2 and 2.2.2.2.1). The command list contains the description of all of these predefined data records. By selecting one of them and pressing SND\_UD you can send it to the slave. However, after installation of *M-Bus Application* there are no predefined commands available but the *command list* contains two default entries:
  - **<No predefined command>:** If you choose this entry you have to enter the complete data record (DIB+VIB+value) to send with the next SND\_UD request. Check if the *value type list* contains the correct type (usually HEX).
  - **<Data record dialog>:** If you choose this entry the *Data Records* dialog appears (you may also choose *Tools->Data Records* from the main menu). With this dialog you can put together the data records to send with a SND\_UD request very simply. See 2.2.2.1 for more details about the *Data Records* dialog

## 2.1.2 Secondary Addressing Section

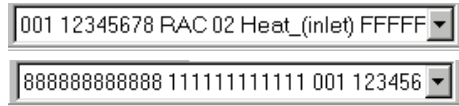
The *Secondary Addressing Section* is used to select slaves. There are several ways to select a slave:

- **M-Bus standard secondary selection:** The standard selection uses the *Device ID*, manufacturer code (*Man*), generation number (*Ge*) and the medium (*Me*). Fill in the appropriate entry fields and press *Slave Select* to select a slave. If you do not want to fill in all entries you may mask out certain nibbles (4 bit) of the secondary address with a wildcard ('F'). All entries are hexadecimal (except *Device ID* which is a BCD value). The checkboxes in front of *Fabrication*, *CustomerA* and *CustomerN* are deselected.
- **M-Bus standard secondary selection with fabrication number:** This is the same as above but an additional data record with the fabrication number is also sent with the selection telegram. Select the checkbox in front of *Fabrication* and another entry field for the fabrication number appears. The checkboxes in front of *CustomerA* and *CustomerN* are deselected.
- **M-Bus customer selection with customer number and / or customer address:** If you select one or both checkboxes in front of *CustomerA* or *CustomerN* all standard secondary selection related entries are disappearing. Therefore, the customer address (*CustomerA*) and / or the customer number (*CustomerN*) are solely used for addressing a slave.

The selection is always done with a mode 1 (LSB first) telegram with CI = 52 (hexadecimal). Mode 2 and older selection telegrams (CI = 51, 55 or 56 (hexadecimal)) are not supported.

The **slave list** contains all slaves already found on the bus. The **slave list** is updated every time you do a slave search or a REQ\_UD2. Use the context menu (right-click the slave list) to clear the **slave list** or to invoke the **Show Slave List** dialog (see 2.2.2.6). Depending on the selection mode the list shows the primary address, device ID, manufacturer, generation and medium (standard selection) or the customer number and address (customer selection). The **slave list** is cleared by starting a slave search if the respective option (see 2.2.3.2) is selected.

You can easily address a slave by selecting it from the **slave list** and press **Slave Select**. The primary address field is automatically set to 253 and a selection telegram for selecting the chosen slave is sent (**Remember that the primary address is automatically changed to 253**).



### 2.1.3 Serial Port Section

In *M-Bus Application* you are able to predefined four sets of serial port communication parameters. By simply selecting one of the four settings you can change the communication parameters. Press **Parameter** to invoke the **COM Parameters** dialog (see 2.2.3.5) for changing the predefined parameters. The fifth selection (**COM off**) is used to close the serial port. As long as one serial port is opened by *M-Bus Application* this port is not available to other applications.

### 2.1.4 Action Buttons



- **SND\_NKE:** sends a SND\_NKE (initialization of slaves) to the specified address (expected answer: E5). Only the primary address field is needed.
- **SND\_UD:** sends a SND\_UD (send user data to slave) to the specified address (expected answer: E5). You have to fill in the primary address, *CI-field*, *DIF-field* (if selected), *Value Type Field* and *Value Entry Field*. You may also use a predefined M-Bus command from the *Command List* (see 2.1.1, 2.2.2.2, 2.2.2.2.1).
- **REQ\_UD1:** sends a REQ\_UD1 (request for class 1 data) to the specified address (expected answer: telegram with alarm data). Only the primary address field is needed.
- **REQ\_UD2:** sends a REQ\_UD2 (request for class 2 data) to the specified address (expected answer: telegram with meter data). Only the primary address field is needed.
- **Slave Select:** sends a slave selection telegram using the entries in the secondary addressing section. A standard or customer selection is sent (see 2.1.2). The **Slave Select** button works only for Mode 1 M-Bus slaves (CI-field: 52H).
- **Slave Search:** performs a search for all slaves connected to the bus. All slaves found are listed in the slave list. Depending on the chosen option the search algorithm will first look for all possible primary addresses (0.250) and will afterwards perform a secondary address wildcard search. You can interrupt the process by pressing the break button. If the program is in primary address search, pressing the break button will skip to the secondary address search. Pressing break again will terminate the slave search. Starting a search will clear the slave list if the slave list reset option (see 2.2.3.2) is chosen. Slaves found in the primary and in the secondary address search will only be listed once. The secondary address search is performed with standard or customer selection and works only for Mode 1 M-Bus slaves (CI-field: 52H).
- **REQ\_UD2 (lower line):** same as REQ\_UD2 but with a repeat count (see 2.2.2.3) Usually the repeat count is set to infinity, therefore, by pressing this button the REQ\_UD2 request is repeated until you press the break button. Only the primary address field is needed.
- **SND\_UDL:** same as SND\_UD but does a *listen only* (waiting for an spontaneous answer) afterwards (see 2.2.2.3, 2.2.2.3.1).
- **Empty:** There are four buttons for user-defined M-Bus scripts or program functions. See 2.2.2.3 and 2.2.2.3.1 for more details. Another twelve buttons are available on the right handside of the *Serial Port Section*.

### 2.1.5 Output Section

The output section contains the *output field* and the *output list*. The *output field* shows the answer of a slave. The

E5
Long: C=08 A=01 CI=72 12345678 RAC 02 Heat_(inlet) 01 00 0000 [+ 2 DR(s)]
Timeout ERROR

answer may be a simple E5 or an error but also a meter data

telegram. If a meter data telegram is received the output list contains the information of the telegrams header:

- **Telegram Type:** *Long*, *LongC*: a long telegram or a long telegram with a another telegram to follow
- **C=08:** value of the C-field
- **A=01:** primary address of the slave
- **CI=72:** value of the CI-field
- **12345678:** device ID
- **RAC:** manufacturer code
- **02:** transmission count
- **Heat\_(inlet):** medium
- **01:** generation number
- **00:** status
- **0000:** signature
- **[+ 2 DR(s)]:** number of data records contained in this telegram. The data records are displayed in the *Output List*.

If the telegram contains any data records, these are displayed in the *Output List*:

Unit	Tariff	Storage	Data	Value	Funct.	VIB
0	0	0	INT4	10.09.1998 01:11	Inst.	Time Point [Date+Time]
0	0	0	INT2	4	Inst.	Hardware Version #
0	0	0	INT2	1002	Inst.	Software Version #

The *Output List* has seven columns displaying the unit number, tariff number, storage number, data type, value, function field and VIB of each data records (variable M-Bus protocol). If a fixed protocol answer telegram is received, unit, tariff and storage are invalid (set to '----') and the function field is always instantaneous.

### 2.1.6 Transmission Tracking List

The *Transmission Tracking List* contains all M-Bus transmissions done from the start of the program. The maximum number of entries depends only on your computer systems memory capacity. You may clear the *Transmission Tracking List* using *Tools->Reset Transmission List* (see 2.2.2.9) or selecting the respective entry in the context menu (right-click the *Transmission Tracking List*). To select an entry you have to click on the respective item in the first column (count). If you click in another column the selection is not changing.

Count	Time	RC	Request	Answer
<b>M</b> 2	21:18:43	1	Select : C=53 A=FD CI=52 CustAddr=FFFFFFFFF...	E5
<b>M</b> 3	21:18:48	1	REQ_UD2: C=7B A=FD	Long: C=08 A=01 CI=72 12345678
<b>M</b> 4	21:27:32	1	SND_NKE: C=40 A=01	E5
<b>M</b> 5	21:28:58	3	SND_NKE: C=40 A=00	Timeout ERROR
<b>M</b> 6	21:38:44	1	REQ_UD2: C=7B A=01	Long: C=08 A=01 CI=72 12345678
<b>M</b> 7	21:39:07	1	SND_UD : C=73 A=01 CI=51 Data=003 Readout D...	E5
<b>M</b> 8	21:39:17	1	SND_UD : C=53 A=01 CI=51 Data=040 Readout H...	E5

The *Transmission Tracking List* contains the following columns:

- **Count:** an index starting from 1 at programstart.
  - **M (green):** received a correct answer with the first attempt
  - **B (blue):** received a correct answer with the second attempt
  - **P (pink):** received a correct answer with the third or with more attempts
  - **R (red):** did not receive a correct answer
- **Time:** time of transmission
- **RC:** request count (number of attempts until the request succeeds)
- **Request:** request telegram



- **Answer:** answer telegram

The context menu of the *Transmission Tracking List* contains the following entries:

- **Copy All:** copies the complete *Transmission Tracking List* into the clipboard
- **Copy Selection:** copies only the selected rows of the *Transmission Tracking List* into the clipboard
- **File (All):** copies the complete *Transmission Tracking List* into a file which can be specified
- **File (Selection):** copies only the selected rows of the *Transmission Tracking List* into a file which can be specified
- **Excel (All):** copies the complete *Transmission Tracking List* directly to Microsoft Excel©
- **Excel (Selection):** copies only the selected rows of the *Transmission Tracking List* directly to Microsoft Excel©
- **Show Buffer:** invokes a dialog with a

Count	Time	RC	Request
M 1	21:16:58	1	REQ_UD2: C=7B A=FF
M 2	21:18:43	1	Se
M 3	21:18:48	1	RE
M 4	21:27:32	1	SN
M 5	21:28:58	3	SN
M 6	21:38:44	1	RE
M 7	21:39:07	1	SN
M 8	21:39:17	1	SN
M 9	21:39:23	1	SN
M 10	21:39:26	1	RE

more detailed view of the selected transmission results

- **Reset Transmission List:** clears the *Transmission Tracking List*
- **List Resizing Slider:** the *List Resizing Slider* on the lower right of the main window can be switched on or off

### 2.1.7 Show Buffer

If you want a more detailed view of a single transmission result you can select it from the *Transmission Tracking List* (remember to click the first column (count), you are not able to select an entry using any other column) and select *Show Buffer* from the context menu. You may also double-click the *Transmission Tracking List* or the *Output List* to invoke the *Show Buffer* dialog.

Corresponds with the count column in the *Transmission Tracking List*

Request in text form

Request in hexadecimal form

Answer in text form (telegram header)

Data records of answer telegram in text form

Answer in hexadecimal form

Start of the next data record

Context help

Resize window

Request: REQ\_UD2: C=7B A=FD

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
000x	10	7B	FD	78	16											

Answer

Long: C=08 A=01 Cl=72 12345678 RAC 02 Heat\_(inlet) 01 00 0000 [+ 2 DR(s)]

Unit	Tariff	Storage	Data	Value	Funct.	VIB
0	0	0	BCD12	888888888888	Inst.	Customer Location
0	0	0	BCD12	111111111111	Inst.	Customer #

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
000x	68	21	21	68	08	01	72	78	56	34	12	23	48	02	0C	01
001x	00	00	00	0E	FD	10	88	88	88	88	88	88	0E	FD	11	11
002x	11	11	11	11	11	0D	16									

## 2.2 Main Menu

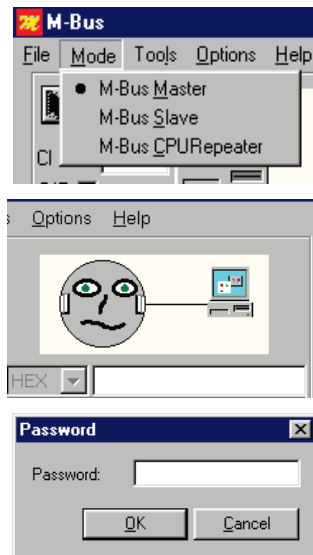
The main menu contains the selection *File*, *Mode*, *Tools*, *Options* and *Help*.

The only selection under *File* is *Exit* for leaving the program. You can also leave the program by pressing ALT+F4 or clicking the right most window button in the *title bar*.

## 2.2.1 Mode

There are three modes you can use in *M-Bus Application*: M-Bus Master, M-Bus Slave, and M-Bus CPURepeater. In M-Bus Master mode the program initiates M-Bus requests and readouts M-Bus slaves. This is the main purpose of the program, therefore, this mode is described in detail later.

In M-Bus Slave mode, however, the program simulates a M-Bus slave. It answers to M-Bus requests according to its settings (see 2.2.3.4 Slave Mode Properties). In M-Bus Slave mode all buttons and menus are disabled since the M-Bus slave is a passive device which only answers to master requests. If M-Bus Slave mode is selected the



picture on the main window changes as shown on the left. To leave the slave mode you have to press the 'Break' button. In M-Bus Slave mode the active COM parameter settings are used. The current baudrate can be changed with the standard M-Bus baudrate commands (CI = B8H .. BFH). Since the slave mode runs on a non real-time operating system it is possible that the maximum allowed M-Bus timeouts can not be granted. This depends on your computer and the workload it has to work off. Therefore, you may have to increase the timeout time while requesting *M-Bus Application* in M-Bus Slave mode.

To exit *M-Bus Application* it has to be in M-Bus Master mode otherwise the exit button will not work.

The M-Bus CPURepeater mode is for a special M-Bus master device called 'CPU-Repeater' or 'Homecentral'. If you select this mode you have to enter the CPURepeater's password. If the password was correct you are attached to the CPURepeater and you can use all functions of *M-Bus Application* as you would do in M-Bus Master mode. Remember though, that there is no confirmation if the login succeeded, therefore, you have to issue a test request. To enter another password enter the M-Bus Master mode and then the M-Bus CPURepeater mode again. To leave the M-Bus CPURepeater mode select the M-Bus Master mode.

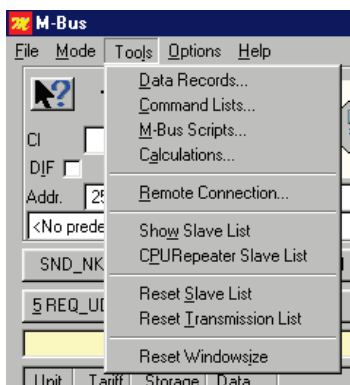
There is only one special function you can only use in M-Bus CPURepeater mode.

This function is the slave list administration of the CPURepeater (see 2.2.2.7 CPURepeater Slave List).

**Please note that you have to increase the timeout offset time (TO) to approx. 1000..2000 ms if you want to communicate using a CPURepeater. Increase the timeout byte time (TB) also to approx. 200..500 bittimes.**

## 2.2.2 Tools

The tools menu contains some useful dialogs.

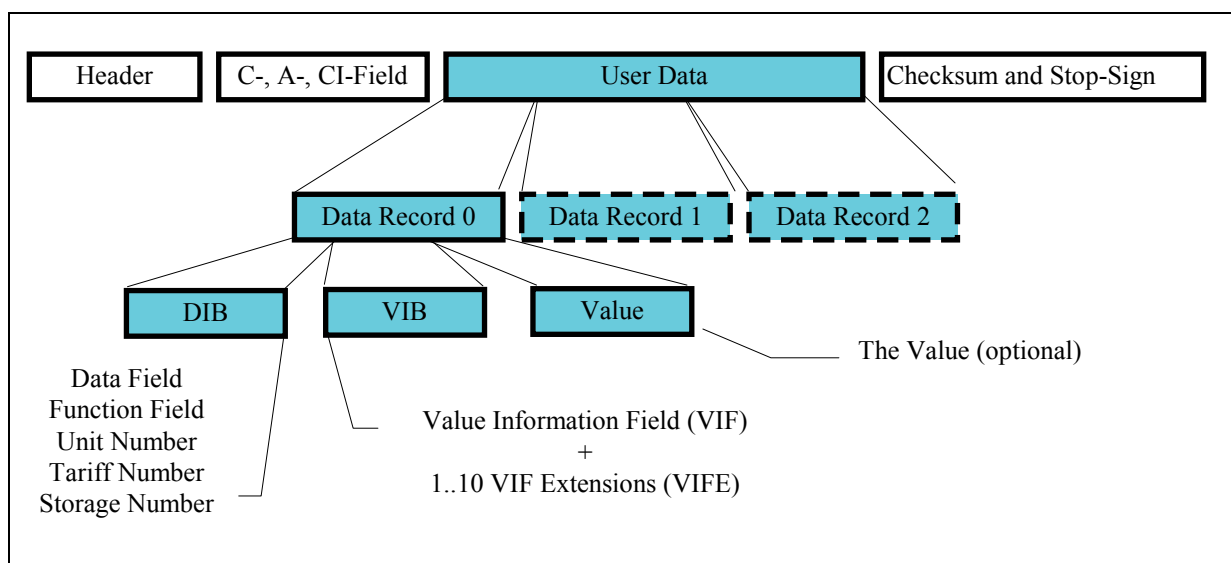


### 2.2.2.1 Data Records

By pressing *Tools->Data Records* the *Data Record* Dialog appears. You may also choose *<Data record dialog>* from the *command list* of the main screen.

A M-Bus long frame telegram sent from Master to Slave usually contains one or more data records. The *Data Record* Dialog provides a convenient method to put together these data records.

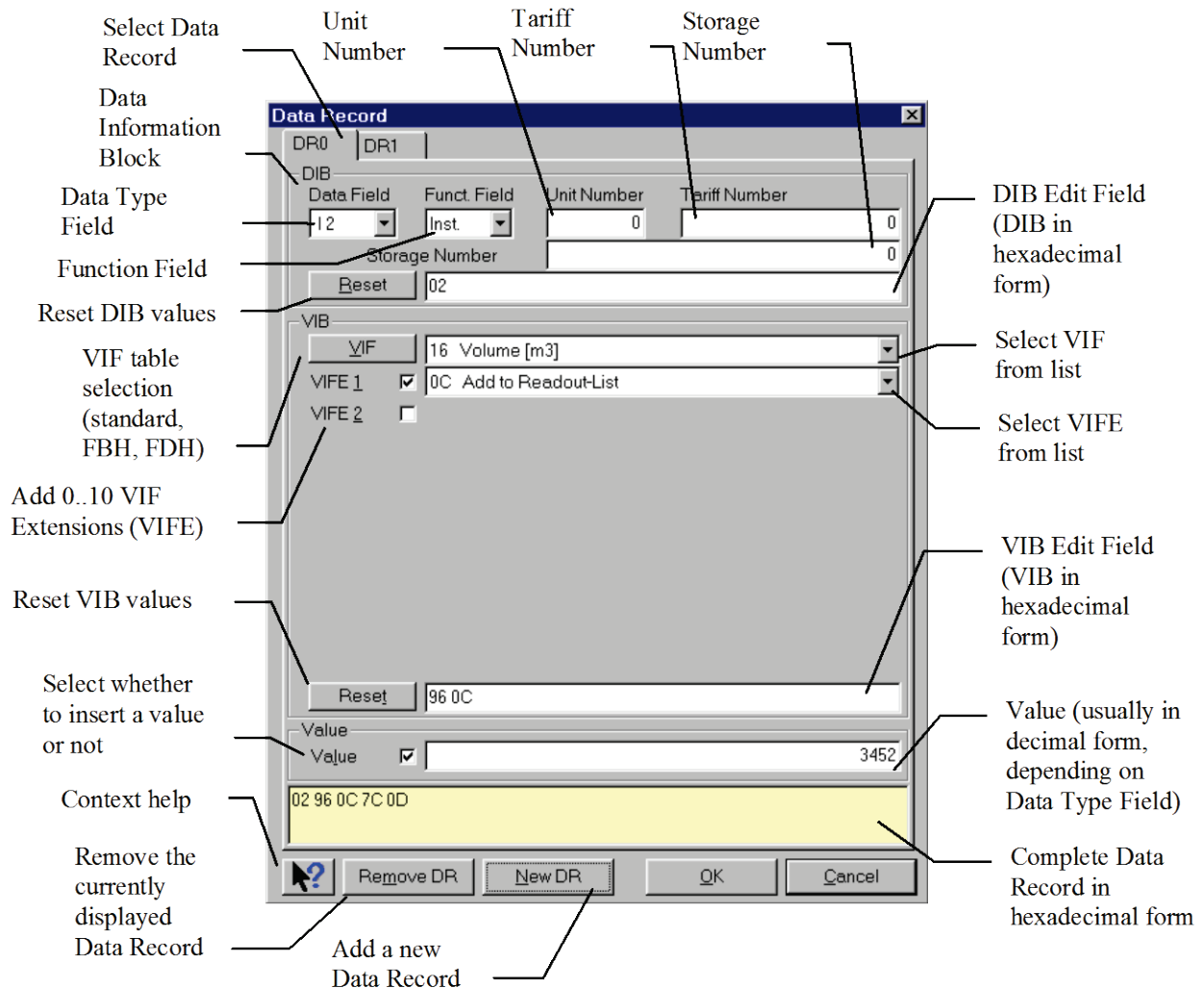
The picture below shows a M-Bus long frame telegram (variable protocol) consisting of a header (start-signs and length-fields), control-field, address-field, control-information-field, the user data, checksum and stop-sign. The user data consists of zero or more data records. Each data records contains a DIB (data information block), a VIB (value information block) and a value. Using the *Data Record* Dialog you can enter and modify all shaded blocks (the user data).



The **Data Information Block (DIB)** contains the following information:

- The **Data Field** describes how the value is encoded. Possible values are:
  - None: No value in this data record
  - I1, I2, I3, I4, I6, I8: Signed integer values with the given number of bytes
  - R4: Real value with 4 bytes
  - Sel: No data but a selection telegram
  - B2, B4, B6, B8, B12: BCD values with the given number of digits
  - Var: Value of variable length
  - Sp1: Special 1 (DIF = 0F, manufacturer specific with no telegram following)
  - D+T: Integer with 4 bytes representing a date and time value (type: F)
  - DAT: Integer with 2 bytes representing a date value (type: G)
  - Sp2: Special 2 (DIF = 1F, manufacturer specific with more telegrams to follow)
  - Idle: Idle filler
  - Glob: Global readout request

If Sp1, Sp2, Idle or Glob. is selected, all etnry fields are disappearing (except *DIB Edit Field*).



- The **Function Field** describes what kind of value is transmitted. Possible values are:
  - Inst.: Instantaneous value
  - Max.: Maximum value
  - Min.: Minimum value
  - Err.: Errorneous value
- The **Unit Number** is a value in the range of [0..1023]. The entry field only accepts decimal values.
- The **Tariff Number** is a value in the range of [0..1048575]. The entry field only accepts decimal values.
- The **Storage Number** is a value in the range of [0..2199023255551]. The entry field only accepts decimal values.

You may reset all values of the DIB by pressing *Reset*. If you change one of the values the *DIB Edit Field* is immediately updated and displays the DIB in hexadecimal form. Instead of changing one of the values described above, you may also enter the DIB into the *DIB Edit Field* (in hexadecimal form).

The **Value Information Block (VIB)** contains information about the type of the data (e.g. physical unit) and is made up of one *Value Information Field (VIF)* and 0..10 *Value Information Field Extensions (VIFE)*.

There are three different VIF-lists to choose from (standard, FBH and FDH). You can cycle through the different lists by clicking the *VIF table selection* button. Selecting a VIF is done by pressing the list and selecting one of its entries.

You can add VIFEs by checking the box on the left handside of the VIF / VIFE lists. Selecting a VIFE is also done by pressing the list and selecting one of its entries.

You may reset all values of the VIB by pressing *Reset*. If you change one of the values the *VIB Edit Field* is immediately updated and displays the VIB in hexadecimal form. Instead of changing one of the values described above, you may also enter the VIB into the *VIB Edit Field* (in hexadecimal form).

Each data record may or may not contain a **value**. The checkbox on the left handside of the value field switches the value entry on or off. Depending on the *Data Field* you have to enter a value in the following form:

- None: No value to enter
- I1, I2, I3, I4, I6, I8: Value in decimal form, e.g. '3234'
- R4: Value as real value, e.g. '2.34'
- Sel: No value to enter
- B2, B4, B6, B8, B12: Value in decimal form, e.g. '3234'
- Var: Variable length value in hexadecimal form, e.g. '12AE4F'
- Sp1: No value to enter
- D+T: Date and time value, e.g. '01.01.1997 12:00'
- DAT: Date value, e.g. '01.01.1997'
- Sp2: No value to enter
- Idle: No value to enter
- Glob: No value to enter

The entry field below the value field displays the complete data record in hexadecimal form. You cannot enter anything in here.

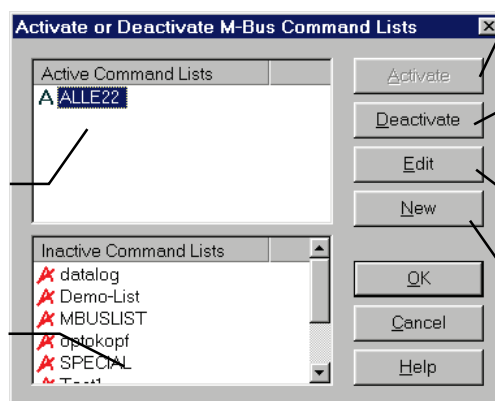
As described above the user data of a variable protocol M-Bus telegram may contain more than one data record. To add a data record press *New DR*. A new page with entry fields appears and you may enter the next data record. Although the number of data records is not limited by the M-Bus protocol, the *Data Record Dialog* can only handle a maximum of 10 data records.

To remove the currently displayed data record press *Remove DR*.

## 2.2.2.2 Command Lists

List of activated command lists (these lists are appearing in the command list on the main screen)

List of deactivated command lists



Activate a command list  
Deactivate a command list  
Edit a command list  
Create a new command list

By pressing *Tools->Command Lists* the dialog for activating or deactivating M-Bus command lists appears. A M-Bus command list contains a set of predefined data records for user-defined purposes e.g. programming a certain meter or sending the M-Bus command to change the baudrate. After

installation of the *M-Bus Application* program there is usually no command list available. To define a new command list press *New*. The *Edit Command List Dialog* appears which is described in detail in 2.2.2.2.1. If you have created one or more command lists their names appear in the *Inactive Command Lists* window. To activate one of these command lists select it in the list and press *Activate* or double-click its name in the list or drag it from one list and drop it into the other. To deactivate a command list select it and press *Deactivate* or double-click its name in the list or drag it from one list into the other. If you want to make changes to an existing command list, select it and press *Edit*.

### 2.2.2.2.1 Create a new M-Bus command list or edit an existing one

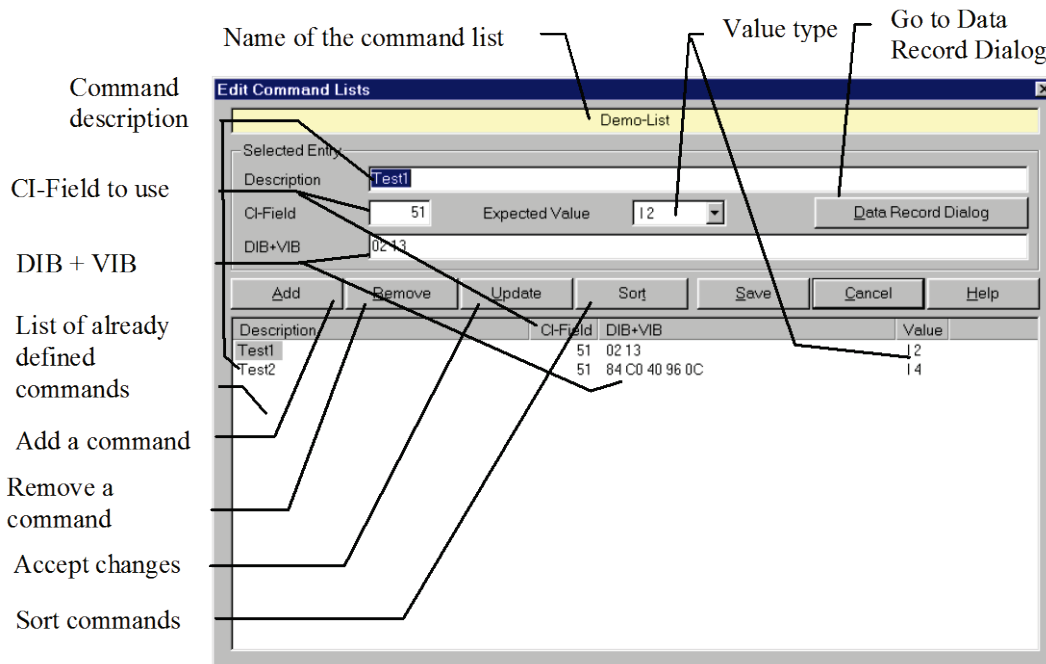
On the *Activate or Deactivate M-Bus Command Lists* dialog press *New* to define a new command list or select an existing one and press *Edit*. Either way the *Edit Command Lists* dialog appears.

A M-Bus command consists of a description, a value for the CI-field, a data record (DIB+VIB only) and a flag describing what kind of value the user has to enter when using this command.

The description entry field accepts up to 60 characters (‘\’ cannot be entered).

The CI-field accepts only hexadecimal characters (1 byte). Non-hexadecimal characters will be rejected.

The DIB+VIB field also accepts only hexadecimal characters. If you do not want to enter the DIB and VIB manually you can press *Data Record Dialog* and use the upcoming dialog to compile a data record (see 2.2.2.1 for details).



If the data record should contain a value you can specify what kind of value the user has to enter (None: no value, Ix: Integer value, Bx: BCD value, D+T: Date and Time, DAT: Date, see also 2.2.2.1).

- To **add** a new M-Bus command entry press *Add* and fill in all entry fields (*Description*, *CI*, *DIB+VIB* and *Expected Value*). Pressing *Update* afterwards will accept your changes. **Remember to press *Update* after you have finished entering the fields. If you do not press *Update* and press *Add* again all changes are lost.**
- To **edit** an existing M-Bus command single-click its description in the list and edit the entry fields. Pressing *Update* afterwards will accept your changes. **Remember to press *Update* after you have finished entering the fields. If you do not press *Update* and press *Edit* again all changes are lost.**
- To permanently **remove** a M-Bus command from the command list single-click its description in the list and press *Remove*.
- To **sort** the M-Bus commands in the list press *Sort*. You will see two lists on the left and right handside, respectively. The left list contains the unsorted commands (all commands in the order you entered them). By double-clicking, single-clicking and using > or by dragging and dropping you can move commands from the left list to the right list. Multiple selections using the *CTRL* or *ALT* keys are possible. The order in the right list will be the new order of the commands. Pressing *Sort* again accepts your changes.

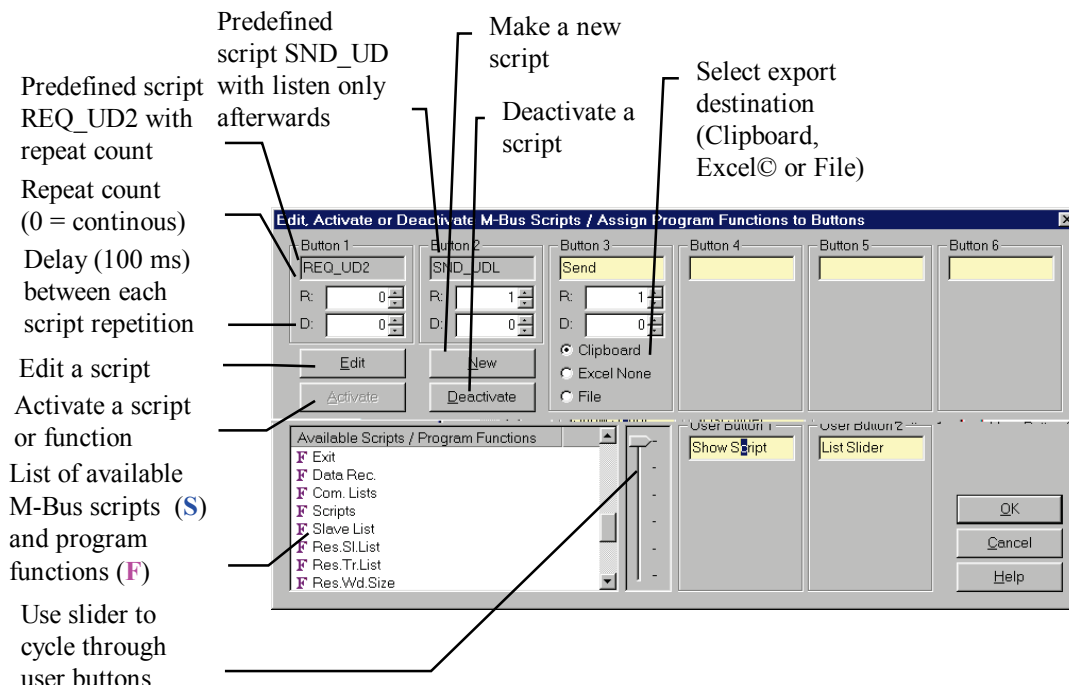
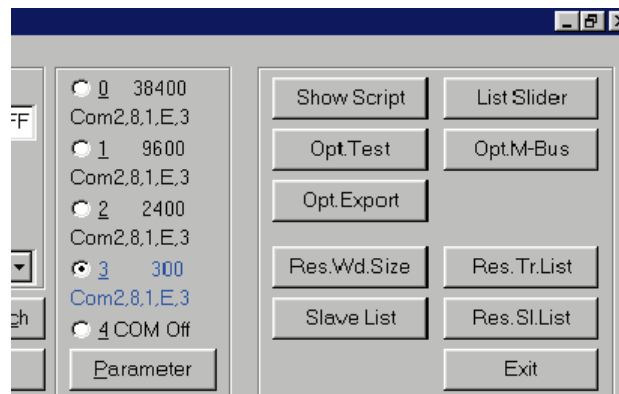
After creating or editing your M-Bus command list you have to save it to disk. The command lists are simple text files with the file extension ‘.MBL’ (see appendix for format specifications). The *M-Bus Application* program only recognizes command lists with the extension ‘.MBL’ which are present in the directory of the executable program file (e.g. ‘C:\PROGRAMS\M-BUSAPPLICATION’). You may save your command lists to any directory you want to but only those in the directory of the executable program are recognized and can be used within *M-Bus Application*.

### 2.2.2.3 M-Bus Scripts

In *M-Bus Application* you are able to define your own M-Bus scripts (a list of M-Bus actions which will be executed sequentially, see appendix for format specifications). You can assign your scripts to one of 16 user-defineable buttons. You may also assign all program functions to one of the user-defineable buttons.

On the *M-Bus Script* Dialog there is a list of all user-defined scripts ('S') and program functions ('F') on the left handside of the dialog. After program installation there are usually no scripts but only functions available. To assign a script or a function to a button you can select the name and press *Activate* (the next available button is assigned to the specified script or function) or double-click the name or drag the name from the list to the button you would like to use.

To deactivate a script or function single-click the button field and press *Deactivate*. To create a new script press *New*. To edit an existing script select the script either in the list or in one of the button fields and press *Edit*.



The button fields on top of the dialog (*Button 1..Button 6*) are corresponding to the six lower action buttons in the main window.

The two button fields below (*User Button 1, User Button 2*) are corresponding to another 12 buttons on the right handside of the COM parameter setting which are only visible if you enlarge the main window. You may use the slider to switch from *User Button 1 and 2* to *User Button 3 and 4* and so on.

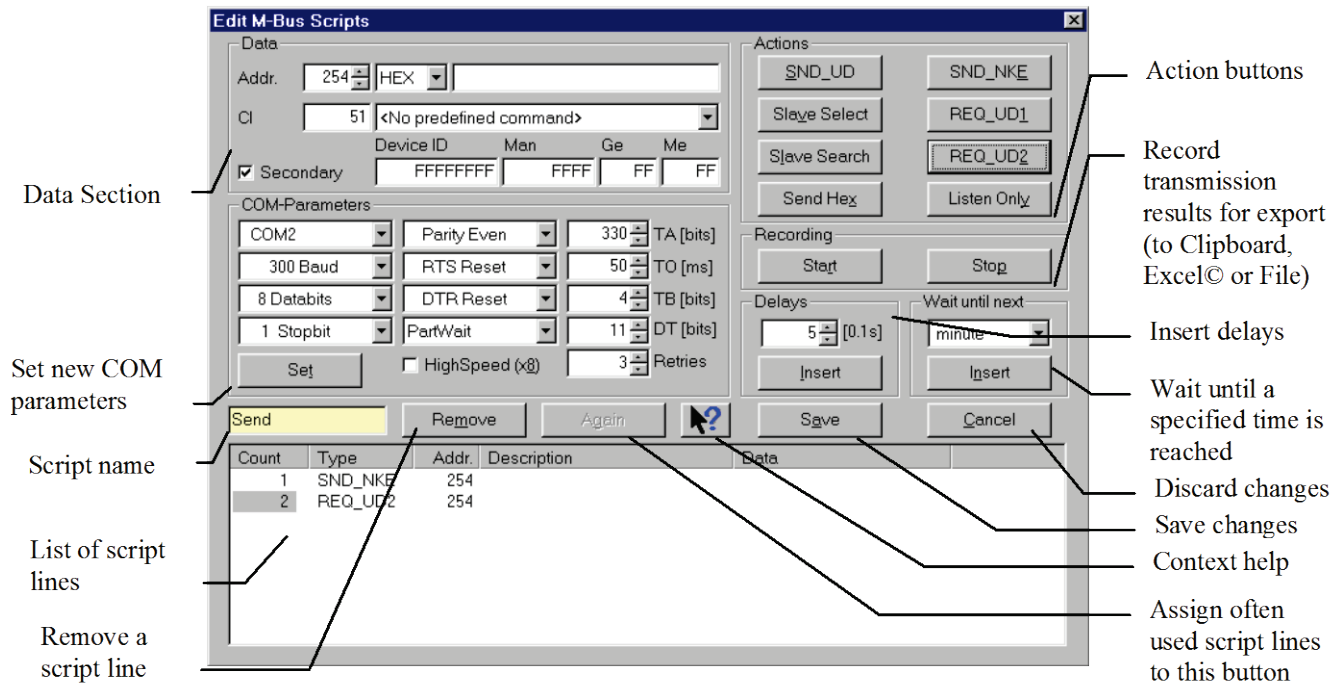
*Button 1* and *Button 2* are containing predefined scripts namely *REQ\_UD2 with repeat count* and *SND\_UD with listen only*.

For each script you may define the number of repetitions ('R': 0..32768) and the delay time between each repetition ('D': in 100 ms). If you set the repeat-count to 0 the script is repeated until you press the break button. You may also define where to send the output of the script: into the clipboard, directly to Microsoft Excel® or into a file. If you select the Excel® option you may also select the key sequence to send to Excel® (see *Options->Data Export* for details) by simply pressing the *Excel* radio button repeatedly.



### 2.2.2.3.1 Edit M-Bus Scripts

You may press *New* to create a new M-Bus script or select an existing script and press *Edit*. Either way the *Edit M-Bus Scripts* dialog appears.



The dialog is divided into several functional groups:

- **Data:** All data you need with one of the M-Bus script lines are entered here. Not all M-Bus script lines need all of the data displayed here, therefore, look at the M-Bus actions below for which parameter is needed:
  - The **primary M-Bus address**. Addresses 0..255 are the standard M-Bus address, addresses 256, 257 and 258 have a special meaning (see also 2.2.2.6):
    - 256: repeats the M-Bus script line for all slaves in the slave list using primary addressing
    - 257: repeats the M-Bus script line for all slaves in the slave list using standard secondary addressing
    - 258: repeats the M-Bus script line for all slaves in the slave list using customer secondary addressing
  - The **CI-field**
  - Any **parameter** or **command** used in conjunction with SND\_UD
  - **Predefined commands** (see 2.2.2.2)
  - **Addressing mode:** primary, secondary or customer (press the checkbox to toggle between the different options)
  - **Device ID, manufacturer, generation and medium** (for standard secondary addressing) or **number and address** (for customer secondary addressing) or nothing (for primary addressing)
- **Actions:** There are several M-Bus related actions you can put in a script line. For a better explanation of each action see 2.1.4:
  - **SND\_UD:** sends a SND\_UD to the slave. You have to fill in the CI-field, the primary address field, the value type list and the request edit field.
  - **Slave Select:** This button is only available if the secondary or customer selection mode is selected in the data section. *Slave Select* sends a selection telegram to the slave. Whether you choose a standard selection or a customer selection you have to fill in the device ID, manufacturer, generation and medium field or the number and address field.
  - **Slave Search:** Searches for all available slaves on the bus. Depending on the selection mode in the data section a primary, a standard secondary or a customer secondary address search is performed. The slave list is updated. Therefore, you may use the special primary addresses 256, 257, 258 (see above) after a *Slave Search*.
  - **Send Hex:** Sends the HEX-bytes in the request edit field to the slave. No M-Bus frame is added but only the entered bytes are sent. Be sure that the value type is HEX while using this command.
  - **SND\_NKE:** sends a SND\_NKE to the slave. You have to fill in the primary address field.



- **REQ\_UD1:** sends a REQ\_UD1 (request for alarm protocol data) to the slave. You have to fill in the primary address field.
- **REQ\_UD2:** sends a REQ\_UD2 (request for user data) to the slave. You have to fill in the primary address field.
- **Listen Only:** sends nothing but waits for an answer (for the specified timeout time). Listen only requires no parameters.
- **Recording:** You can export specified transmission results either to the clipboard, directly to Microsoft Excel© or into a file. This depends on the selection you made in the M-Bus script dialog (2.2.2.3). Only those transmission results are exported which are included in a *RecStart* - *RecStop* bracket. Press *Start* in front of the first script line which transmission results you would like to export and press *Stop* after the last script line you would like to export. You may use more than one *RecStart* - *RecStop* bracket. After script execution the results are exported immediately (e.g. the results are available in the clipboard).
- **Delays:** Inserts a delay of specified duration between two script lines. The delay is given in 1/10 of a second (100 ms).
- **Wait until next:** Inserts a delay which goes until the next full minute (system time), next full two minutes, next full five minutes and so on. A delay until the next full twenty minutes e.g. will go until the computer system time is at 20 minutes past the full hour, 40 minutes past the full hour or at full hour depending on the time the script line is executed. With this option you can realize a readout at specified times e.g. every minute or every five minutes and so on.
- **COM Parameters:** You can alter the COM parameter settings during the execution of your script. After script execution has finished the COM parameters are restored to the values before script execution. Use the *Set* button to insert a COM parameter change in your script. For a better explanation see the *COM Parameter* dialog description.

All M-Bus script lines are displayed in the list. If you want to remove a script line, select it by single-clicking the first column of the line and press **Remove**. If there is a M-Bus action you have to insert rather often you may assign this action to the button **Again**. Select the specified script line and press the right mouse-button. Select 'Assign to Again' from the upcoming context menu. The button *Again* will no longer be disabled and every time you press *Again* the selected line will be inserted. After you have finished editing your script you can save it to disk. Press **Save** and enter a unique name for your script. **The default name 'Unnamed' is not a valid name for a M-Bus script, therefore, you have to change it.**

The *M-Bus scripts* are simple text files with the file extension '.MBS' (see appendix for format specifications). The *M-Bus Application* program only recognizes *M-Bus scripts* with the extension '.MBS' which are present in the directory of the executable program file (e.g. 'C:\PROGRAMS\M-BUSAPPLICATION'). You may save your M-Bus scripts to any directory you want to but only those in the directory of the executable program are recognized and can be used within *M-Bus Application*.

#### 2.2.2.4 Calculations

Available fixed protocol media

Available variable protocol media

Translate a three character manufacturer code into 2 byte HEX-code and vice versa

Calculate Dates Type F

Calculate Dates Type G

Entry fields : DES encrypt and decrypt

A small dialog which displays all possible fixed and variable M-Bus protocol media. Press the media field to open the list. The HEX-code for each media is shown on the left handside of each list.

There is also the opportunity to calculate the M-Bus manufacturer code from its three character form. Enter three uppercase letters in the left edit field and read the M-Bus manufacturer HEX-code in the right edit field and vice versa. Although you can enter anything, for a valid M-Bus manufacturer code you have to enter uppercase letters (no numbers) in the left edit field and HEX-characters in the right one.

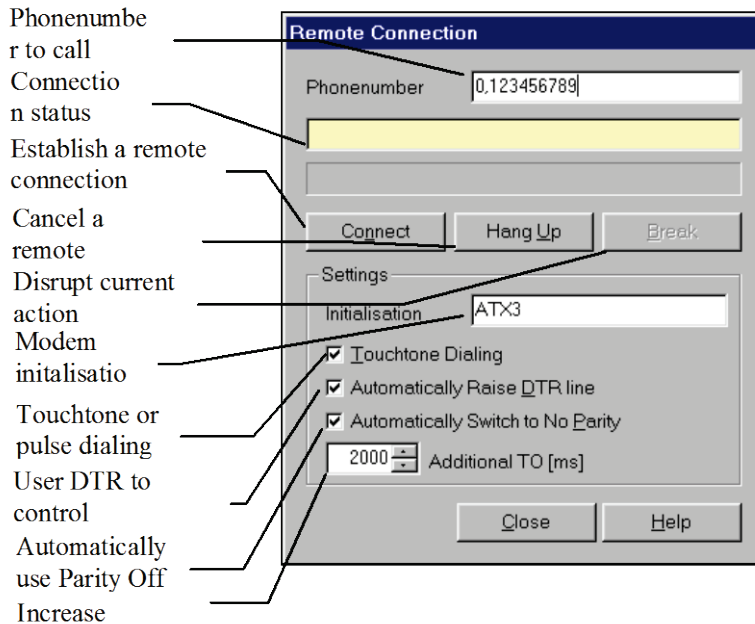
For calculating the M-Bus Type F and G date types you may either enter the date in readable form (DD.MM.YY HH:MM or DD.MM.YY) which is instantaneously translated to the respective M-Bus coded form or you may enter the M-Bus coded date in HEX format (LSB first) and the program gives the date in readable form. If you want to set the summertime bit in type F write an "S" in front of the date (e.g. S31.12.05 23:59). If you want to set the invalid bit in type F write an "I" in front of the date (e.g. I31.12.05 23:59).

Additionally, this dialog provides a DES (Data Encryption Standard) encryption / decryption calculator. A DES encryption is used with some meter devices. For more information on the DES algorithm see e.g. '<http://www.abisoft.net/des.html>'. You may encrypt / decrypt using the ECB (Electronic Codebook) mode or the CPB (Cipher Block Chaining) mode.

The DES algorithm is based on 64 bit (8 byte) words. Enter the 64 bit key in hexadecimal form into the Key entry field. If you want to use the CPB mode enter the 64 bit initialisation vector in the IV entry field. For ECB mode enter zeros. Enter the 64 bit data word to encrypt / decrypt into the Data entry field. Press Encrypt or Decrypt to perform the desired operation and the contents of the Data entry field is replaced by the result of the operation.

### 2.2.2.5 Remote Connection

This dialog is used to initiate and cancel a remote connection via modem devices (AT-Hayes compatible command set). You have to enter a phonenumber and press the 'Connect' button to initiate a call. The status line and the progress bar will show you the progress of the ongoing connection process. The status line will display 'Connection established' if the line is transparent and you can close the dialog. The main window will now display a different picture to show you that a remote connection is active. You can work over the remote connection the same ways you can work using the direct M-Bus connection. To cancel the connection open the 'Remote Connection' dialog again and press 'Hang Up'. M-Bus Application uses the active COM settings for remote connections. However, you can override three parameters which will be explained next.



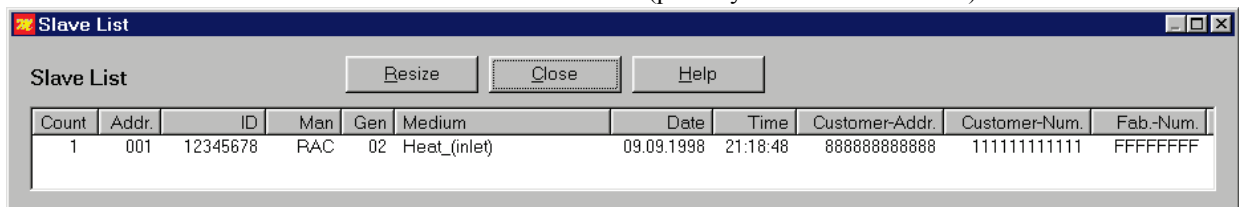
- **Initialisation:** Enter an AT command for initialising the modem prior to sending the dial string (Default: 'ATX3').
- **Touchtone Dialing:** Check this box if you want touchtone dialing (the ATDT command is used). Deselect it if you want pulse dialing (the ATDP command is used, Default: checked).
- **Automatically Raise DTR Line:** If this box is checked the DTR line is raised prior to any command to the modem. After a call has been established lowering the DTR line is used to force the modem to hang up. After hanging up the previous DTR line setting is restored (Default: checked).
- **Automatically Switch to No Parity:** Since most modern modems are not capable of transmitting 8 databits and an additional parity bit (e.g. 8E1), usually no parity is used during remote connections (8N1). By checking this box the parity is always disabled during a remote connection regardless of the COM port setting. After the connection is canceled the previous parity setting is restored (Default: checked).
- **Additional TO [ms]:** The standard TO time is increased by the given value since remote connections usually have a lag. After the connection is canceled the previous parity setting is restored (Default: 2000 ms).

### 2.2.2.6 Show Slave List

A list of all slaves found on the bus. You can sort the list by pressing the header of a column. You can remove a slave permanently from this list by selecting 'Remove Slave(s)' from the lists context menu (right-click somewhere in the list). See 2.2.2.3.1 for the special purpose of the slave list in M-Bus scripts. The slave list has the following columns:

- **Count:** index in list
- **Addr:** primary address
- **ID:** device ID
- **Man:** manufacturer code
- **Gen:** generation number
- **Med:** medium
- **Date:** the date the slave was first found on the bus
- **Time:** the time the slave was first found on the bus
- **Customer-Addr.:** customer address (if not available: FFFFFFFFFF)
- **Customer-Num.:** customer number (if not available: FFFFFFFFFF)
- **Fab.-Num.:** fabrication number (if not available: FFFFFFFF)

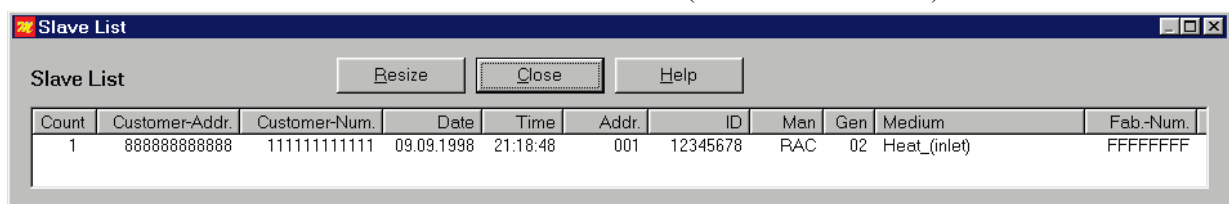
Slave list in standard selection mode (primary address column first)



The image shows a software window titled "Slave List" with a standard Windows-style title bar (minimize, maximize, close buttons). Below the title bar, there are three buttons: "Resize", "Close", and "Help". The main area of the window contains a table with the following columns: Count, Addr., ID, Man, Gen, Medium, Date, Time, Customer-Addr., Customer-Num., and Fab.-Num.. The table has one data row with the following values: Count: 1, Addr.: 001, ID: 12345678, Man: RAC, Gen: 02, Medium: Heat\_(inlet), Date: 09.09.1998, Time: 21:18:48, Customer-Addr.: 888888888888, Customer-Num.: 111111111111, and Fab.-Num.: FFFFFFFF.

Count	Addr.	ID	Man	Gen	Medium	Date	Time	Customer-Addr.	Customer-Num.	Fab.-Num.
1	001	12345678	RAC	02	Heat_(inlet)	09.09.1998	21:18:48	888888888888	111111111111	FFFFFFFF

Slave list in customer selection mode (customer address first)

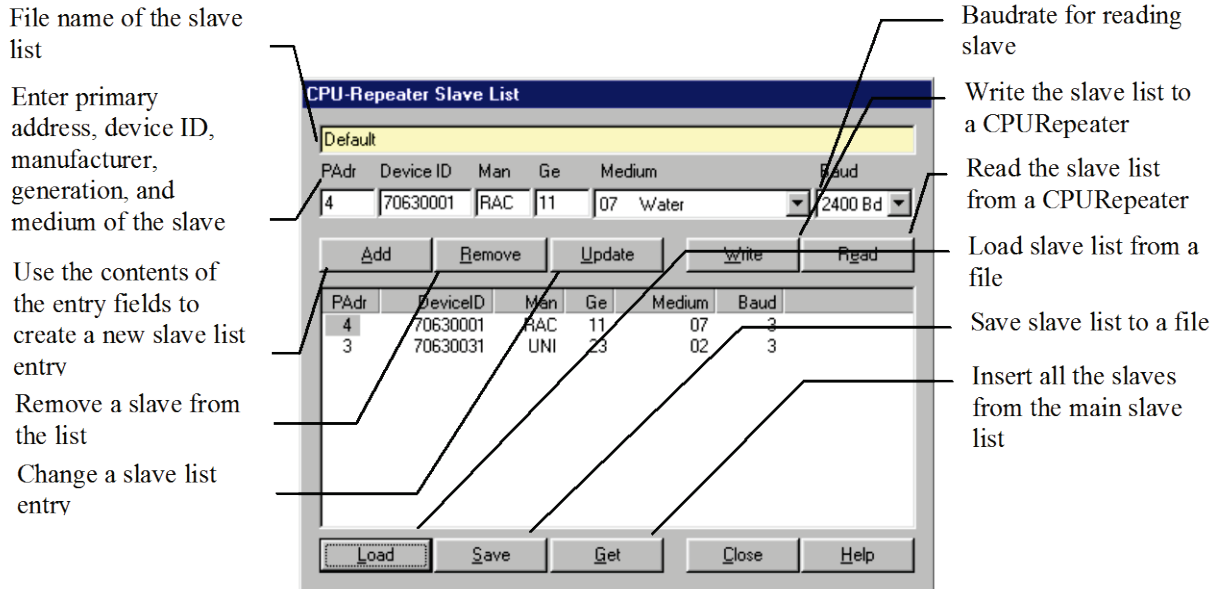


The image shows a software window titled "Slave List" with a standard Windows-style title bar (minimize, maximize, close buttons). Below the title bar, there are three buttons: "Resize", "Close", and "Help". The main area of the window contains a table with the following columns: Count, Customer-Addr., Customer-Num., Date, Time, Addr., ID, Man, Gen, Medium, and Fab.-Num.. The table has one data row with the following values: Count: 1, Customer-Addr.: 888888888888, Customer-Num.: 111111111111, Date: 09.09.1998, Time: 21:18:48, Addr.: 001, ID: 12345678, Man: RAC, Gen: 02, Medium: Heat\_(inlet), and Fab.-Num.: FFFFFFFF.

Count	Customer-Addr.	Customer-Num.	Date	Time	Addr.	ID	Man	Gen	Medium	Fab.-Num.
1	888888888888	111111111111	09.09.1998	21:18:48	001	12345678	RAC	02	Heat_(inlet)	FFFFFFFF

### 2.2.2.7 CPURepeater Slave List

Using this tool you can administrate the slave list within a CPURepeater. You must be in M-Bus CPURepeater mode to read or write the slave list from or to a CPURepeater. You can manually add slaves to the list, remove slaves from the list, and change existing entries. You may also read or write the slave list to a file. Another option is to get all the slaves from the main slave list.



- To manually **add** a new slave to the list fill in the entry fields for the primary address (PA<sub>dr</sub>), the device ID, the manufacturer code (Man), the generation (Ge), the medium, and select the baudrate with which to read out the slave. Press Add after all entries are made.
- To **remove** a slave from the list click on the primary address of the slave you want to remove (first column of the list) and press Remove.
- To **change** the data of an existing slave select the respective slave by clicking its primary address (first column of the list). Change the entry fields as appropriate and press Update afterwards.
- To **write** the slave list to a CPURepeater press Write. Remember that you must be in M-Bus CPURepeater mode for reading or writing the slave list.
- To **read** the slave list of a CPURepeater press Read. Remember that you must be in M-Bus CPURepeater mode for reading or writing the slave list.
- Using **Load** and **Save** you can save a slave list to a file and read it again.
- The **Get** button adds all the devices in the main slave list (see 2.2.2.6) to the CPURepeater slave list.

### 2.2.2.8 Reset Slave List

All slaves in the slave list are deleted.

### 2.2.2.9 Reset Transmission List

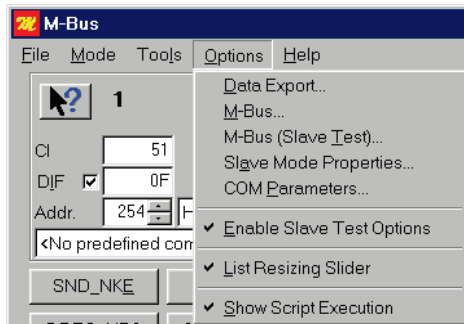
All entries of the transmission list are deleted.

### 2.2.2.10 Reset Window size

The size of the main window is reset to default.

### 2.2.3 Options

The menu point *Options* provides access to some useful configuration dialogs.



#### 2.2.3.1 Data Exports

You are able to specify the export format of the *Transmission Tracking Lists* entries. You can export the entries of the *Transmission Tracking List* into the clipboard, to a file or directly to Microsoft Excel© (see 2.1.6 for details). The following options are available:



- **Export Requests:** Check this option to export all M-Bus master requests.
- **Export Answers:** Check this option to export M-Bus slave answers.
  - **Export E5:** If the *Export Answers* option is selected you may also choose if you want to export single-character acknowledge answers (E5) or not.
  - **Export Errors:** If the *Export Answers* option is selected you may also choose if you want to export erroneous slave answers or not.

All entries can be exported as readable text (**Export as Text**), as HEX-bytes (**Export as HEX-bytes**) or as decimal bytes (**Export as Decimal-bytes**).

For Microsoft Excel© data exports you can enter a **key sequence** which will be sent to Excel immediately after the data is exported. To gain access to the menu of Microsoft Excel© there is a special key which can be specified in the Microsoft Excel© options dialog (usually '/'). A '/' will be interpreted as an ENTER-keypress. Therefore, you can control most functions of Microsoft Excel© with this feature (e.g. start a macro, autofomat).

- **Example:** '/tfl!' will autofomat the exported data (using the german Microsoft Excel© menu keys). To start a macro it must be defined in your personal Microsoft Excel© map, which is loaded on program start and it must have an entry in the extras menu of Microsoft Excel©.



### 2.2.3.2 M-Bus

There are several M-Bus related options:

Check if datarecords with an error-VIFE have a Choose language of VIF and VIFE

Slave search option

CI-Field for Slave Search

Check if *Slave List* should be cleared before a slave search

Automatic request options

VIF Units without multiplier

Standard or alternate string VIF decoding

FCB option for incoming telegrams (REQ\_UD)

FCB option for outgoing telegrams (SND\_UD)

FCB / FCV option for address 255

Set size of *Output List* and *Transmission Tracking List*

Deciphering of PRIOS telegrams

Deciphering of DES telegrams

Deciphering of AES128 telegrams

- **Value-field in data records with error-VIFE:** Check this option if a value follows a slave record error-VIFE. Do not check this option if no value follows a slave record error-VIFE (Default: Checked).
- **M-Bus VIF / VIFE language:** Selects if the VIFs and VIFEs are displayed in English or German. All transmission error messages are also displayed in the selected language.
- **Slave Search:**
  - **Primary Address Search:** Check this option if you want to perform a primary address search using the *Slave Search* Button (Default: Checked).
  - **Secondary Address Search:** Check this option if you want to perform a secondary address search using the *Slave Search* Button (Default: Checked).

If both search options are checked a primary address search will be performed first followed by a secondary address search. If both options are de-checked no slave search will happen.

- **CI-Field :** Selects which CI-Field value should be used with a slave selection telegram. Do not alter the default setting ('CI=52H') unless you are using an older M-Bus slave.
- **Reset slave list before slave search:** Check this option if you want the slave list to be cleared before a new slave search. Do not check this option if the slave list should not be cleared before a slave search (Default: Checked).
- **Automatic REQ\_UD1 on ACD:** If a RSP\_UD telegram with *Access Demand Bit* (ACD) set is received, a REQ\_UD1 is automatically sent if this option is checked (Default: Checked).
- **Automatic REQ\_UD2 on DIF = 1F:** If a RSP\_UD telegram with a data record containing DIF = 1F is received, another REQ\_UD2 is automatically sent if this option is checked (Default: Checked).
- **Only VIF Units without multiplier:** If you check this option all VIFs containing a multiplier are replaced by VIFs without multiplier. The value is recalculated accordingly (e.g. 3244 'Energy 100 [Wh]' will be replaced by 324400 'Energy [Wh]'). This feature is not working with VIFs from table 'FB' with an index smaller 50 (decimal). If this option is not checked all VIFs are returned 'as they are'.
- **Alternate VIF 0x7C Interpretation:** If you check this option for VIF with strings and VIF extensions a different decoding is used (used by few meters).
- **FCB SND\_UD / FCB REQ\_UD:** How to handle the *File Control Bit* (FCB) and the *File Control Valid Bit* (FCV) in SND\_UD and REQ\_UD telegrams:
  - **FCB / FCV reset:** FCB and FCV are always reset
  - **FCB toggle:** Standard M-Bus FCB handling (Default)
  - **FCB inverted:** Same as FCB toggle but with inverted FCB
  - **FCB set:** FCB and FCV are always set
  - **FCB reset:** FCB is always reset, FCV is always set

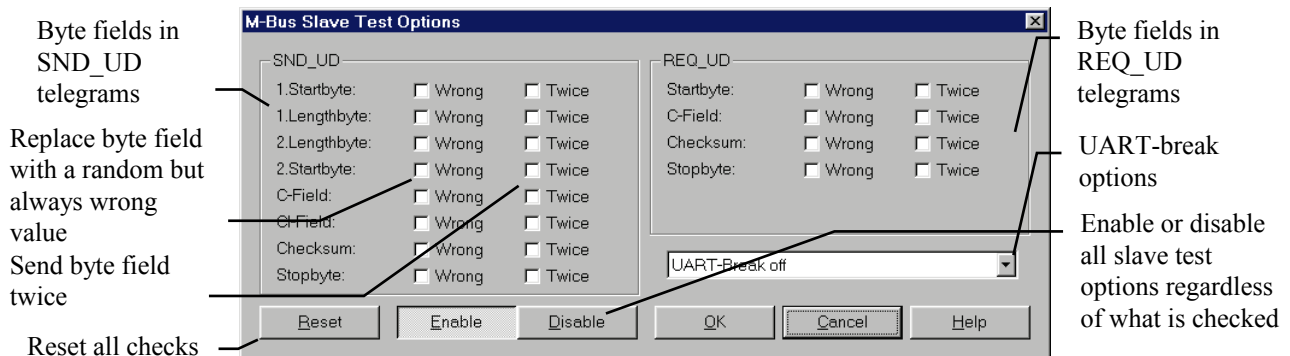
- **FCB / FCV reset for address 255:** Check this option if you want to reset FCB and FCV always in REQ\_UD and SND\_UD telegrams to address 255. If this option is not checked the address 255 is treated the same as any other address in respect to FCB / FCV handling (Default: Checked).

**NOTE:** The internal FCB backup bits are not altered after changing the FCB options. You have to issue a SND\_NKE to address 255 to reset all FCBs if you have changed one of the FCB options.

- **Size of Data Record List Window:** You can enter the size of the data record list on the main window in screen units. Values between 10 and 1000 units are valid, default is 65 units. The transaction tracking list is automatically resized. The reset button sets the size to 65 units (default). It is also possible to resize the lists with the slider (*Options->List Resizing Slider*).
- **Only VIF Units without multiplier:** If you check this option all VIFs containing a multiplier are replaced by VIFs without multiplier. The value is recalculated accordingly (e.g. 3244 'Energy 100 [Wh]' will be replaced by 324400 'Energy [Wh]'). This feature is not working with VIFs from table 'FB' with an index smaller 50 (decimal). If this option is not checked all VIFs are returned 'as they are'.
- **Automatic PRIOS Decryption:** Telegrams with PRIOS encryption can be automatically decrypted if either the standard key option is chosen or a specific decryption key is entered.
- **DES Key:** Some meters on the market deliver their data only in encrypted form. If you enter a DES key different from 'FFFFFFFFFFFFFFFF' the automatic DES decryption (CPB mode) is enabled. If a device with DES encryption is read out the data is automatically decrypted to M-Bus form. If the DES key is set to 'FFFFFFFFFFFFFFFF' the automatic DES decryption is disabled.
- **Automatic AES128 Decryption:** Telegrams with AES128 encryption can be automatically decrypted if the automatic AES128 decryption option is enabled and a 16 bytes (32 characters) AES128 key is entered.

### 2.2.3.3 M-Bus (Slave Test)

This dialog is used for testing M-Bus slaves. You can intentionally alter your request telegrams (SND\_UD and REQ\_UD) and see if a slave is still answering. If so, the slaves M-Bus protocol-decoding is not working properly.



There are two ways to alter specified byte-fields (e.g. start-byte, address-byte, stop-byte) of the M-Bus request telegrams:

- **Wrong:** the byte-field is set to a random but always wrong value (e.g. second length-byte: some slaves only decode the first length-byte. This is not correct since both length-byte must be decoded and compared. By sending a wrong second length-byte you can recognize if a slave is not decoding both length-bytes.)
- **Twice:** the byte-field is sent twice instead of once (e.g. stop-byte: some slaves only read a telegram until they recognize the stop-byte (16H). This method is not correct since the end of a telegram must be recognized by a timeout. By sending the stop-byte twice you can recognize this.)

There is also the possibility to send an UART-break (TX continuously active). On an UART-break each slave has to stop sending immediately. Three options are available:

- **UART-break off:** no UART-break
- **UART-break after request:** after all request bytes are sent and the deadtime (usually 11 bittimes) is over an UART-break is asserted. The UART-break is active until timeout-time.
- **UART-break after first received byte:** an UART-break is asserted after the first byte of a slave is received. The UART-break is active until timeout-time.



You can globally enable and disable the slave test options by pressing **Enable** or **Disable**. Therefore, if you have checked more than one byte-field you do not have to uncheck and check them all if you want to switch from enabled to disabled slave test or vice versa. *Options->Enable Slave Test Options* from the main menu is doing the same.

By pressing **Reset** you can reset all slave test options.

If a slave test option is active the window title of the main window is showing a warning message.

#### 2.2.3.4 Slave Mode Properties

This dialog defines the behavior of M-Bus Application in slave mode. All important byte fields, addresses and other settings can be changed. You can initiate the slave mode by pressing 'Mode->M-Bus Slave'. M-Bus Application is no longer a M-Bus master then but behaves like a slave (answers to M-Bus request instead of initiating them).

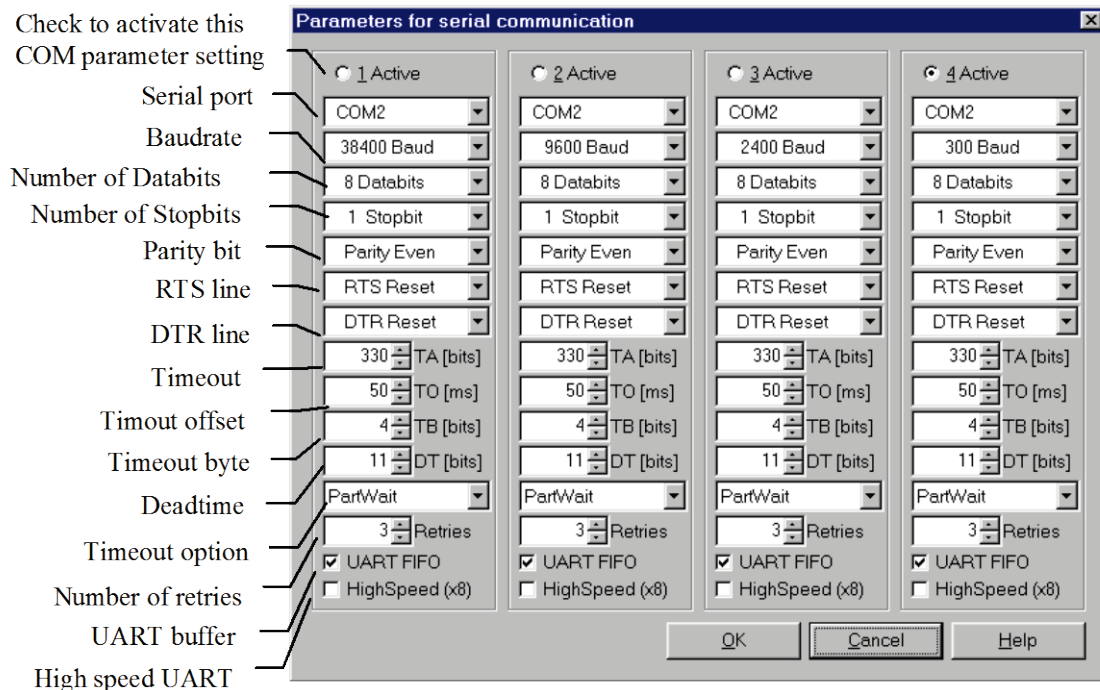
The screenshot shows the 'M-Bus Slave Mode Properties' dialog box. It contains several input fields and a table. Annotations on the left point to specific fields: 'Control Field for RSP\_UD' points to 'RSP\_UD C-Field' (value 08); 'Control Information Field for RSP\_UD' points to 'RSP\_UD CI-Field' (value 72); 'CI Field for' points to 'Selection CI-Field' (value CI=52H); 'Primary Address' points to 'P-Address' (value 1); 'Status field' points to 'Status' (value 00); 'Signature field' points to 'Signature' (value 0000); 'Datarecords for answer to REQ\_UD2 with C = 7BH' points to the first data record field; 'Datarecords for answer to REQ\_UD2 with C = 5BH' points to the second data record field; and 'Use same datarecords for all RSP\_UD' points to the 'Same as for C-Field = 7BH' checkbox. Annotations on the right point to the 'Complete secondary address including fabrication number and customer number and address' (referring to the table), and two 'Invoke Data Record dialog' (referring to the 'Datarecord' buttons).

Device ID	Man	Ge	Me
12345678	4823	00	0E
Fabrication			
12345678			
CustomerA			
123456789000			
CustomerN			
123456789999			

- **RSP\_UD C-Field:** Control field of RSP\_UD answer (hexadecimal, Default: 08H).
- **RSP\_UD CI-Field:** Control information field of RSP\_UD answer (hexadecimal, Default: 72H).
- **Selection CI-Field:** What control information field stands for a slave select (hexadecimal, Default: 52H).
- **P-Address:** Primary address (decimal, Default: 1).
- **Status:** Status field (hexadecimal, Default: 00H).
- **Signature:** Signature field (hexadecimal, Default: 0000H).
- **DeviceID:** Device identity field (hexadecimal / BCD, Default: 12345678).
- **Man:** Manufacturer code (hexadecimal, Default: 4823H).
- **Ge:** Generation code (hexadecimal, Default: 00H).
- **Me:** Medium code (hexadecimal, Default: 0EH).
- **Fabrication:** Fabrication number (hexadecimal, Default: 12345678H).
- **CustomerA:** Customer address (hexadecimal, Default: 123456789000H).
- **CustomerN:** Customer number (hexadecimal, Default: 123456789999H).
- **Answer to REQ\_UD2 with C-Field = 7BH:** The 'payload' of the RSP\_UD answer to a REQ\_UD2 with set FCB. You can enter any hexadecimal values up to the maximum size of 252 bytes. If you want to put together your datarecords with a dialog use the 'Datarecord' button which displays the 'Data Record' dialog. Any settings there will be added to the existing entries in this field.

- **Answer to REQ\_UD2 with C-Field = 5BH:** The ‘payload’ of the RSP\_UD answer to a REQ\_UD2 with reset FCB. The same as above. If you do not want two different telegrams for each FCB setting check the box in front of ‘Same as for C-Field = 7BH’.

### 2.2.3.5 COM Parameters



The COM parameter setting dialog lets you define four sets of transmission parameters for serial communication. You can activate one of the parameter sets using the activate box or selecting it on the main window (see 2.1). The following options are available:

- **Active:** Check this box to activate one of four parameter settings.
- **COM port:** Selects the COM port to use (COM1..COM20)
- **Baudrate:** Selects the baudrate. Available baudrates are: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800 and 921600 baud. Baudrates above 115200 are only available with high-speed UARTs (see High-Speed option below). **Recommended M-Bus baudrates are 300, 2400, 9600 and 38400 baud.**
- **Databits:** Selects the number of databits per byte. 5, 6, 7 and 8 databits per byte are available (**M-Bus default: 8 databits**).
- **Stopbits:** Selects the number of stopbits per byte. 1, 1.5 and 2 stopbits are possible. 1.5 stopbits is not available on some systems (**M-Bus default: 1 stopbit**).
- **Parity Setting:** Selects the parity setting. Available settings are Parity off, Parity even and Parity odd (**M-Bus default: Parity even**).
- **RTS option:** Selects how the RTS-line of the serial COM port is controlled. Available options are Reset, Set, Handshake and Toggle (**M-Bus default: Reset**).
  - **Handshake:** The RTS line is set if the UART input buffer is less than half full. The RTS line is reset if the UART input buffer is more than three-quarters full.
  - **Toggle:** The RTS line is set if there are bytes to transmit in the UARTs transmit buffer. The RTS line is reset if there are no bytes to transmit
- **DTR option:** Selects how the DTR-line of the serial COM port is controlled. Available options are Reset, Set and Handshake (**M-Bus default: Reset**).
- **Timeout TA:** Selects the maximum allowed time between sending a request and receiving an answer telegram in bittimes (**M-Bus default: 330 bittimes, see 3 for more details about M-Bus timeouts**).
- **Timeout TO:** Selects an offset to the TA timeout in milliseconds. The tolerable time between a request and an answer is therefore TA [bittime] + TO [milliseconds] (**M-Bus default: 50 milliseconds, see 3 for more details about M-Bus timeouts**).

- **Timeout TB:** This is the maximum allowed time between receiving two bytes of an answer telegram before the end of a telegram is recognized (**M-Bus default: 4 bittimes, see 3 for more details about M-Bus timeouts**).
- **Deadtime DT:** This is the time in bittimes from the end of the last byte sent to the time the program opens its receive channel. All bytes received before opening the receive channel are rejected. This option is used to cancel echoes on the transmission lines. (**M-Bus default: 11 bittimes, see 3 for more details about M-Bus timeouts**).
- **Timeout Mode:** There are three different timeout modes available (**M-Bus default: Part Wait, see 3 for more details about M-Bus timeouts**):
  - **No Wait:** After recognizing the end of an answer telegram the program will not wait for another telegram even if there is timeout time left.
  - **Full Wait:** The program will always wait the full TA + TO time.
  - **Part Wait:** After receiving an answer telegram the program will only wait TA bittimes (counted from the first byte of the answer telegram) for another telegram (recommended setting).
- **Retries:** Maximum number of retries until a request is cancelled (**M-Bus default: 3**).
- **UART FIFO:** If the UART of the computer system has an internal FIFO or not. The operating system checks less often for new bytes if the FIFO is on and in use. Therefore, the TB timeout is automatically increased if this option is selected.
- **HighSpeed (x8):** Check this option if the UART of your computer system is a high-speed UART (works with 8 times the standard frequency). Standard UARTs are able to generate baudrates between 300 and 115200 baud, high-speed UARTs are able to generate 600 to 921600 baud.

#### 2.2.3.6 Enable Slave Test Options

You can globally enable or disable the slave test options (see 2.2.3.3 for details).

#### 2.2.3.7 List Resizing Slider

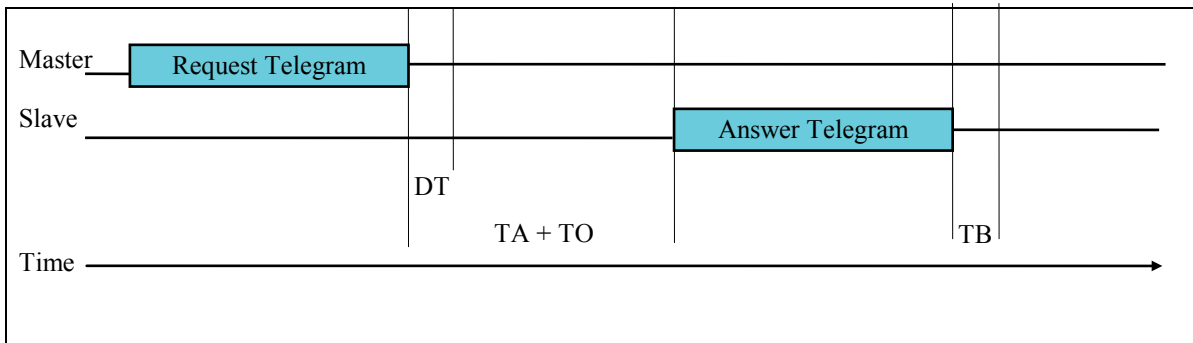
Switches the list resizing slider (see 2.1) on or off.

#### 2.2.3.8 Show Script Execution

During script execution time (see 2.2.2.3 and 2.2.2.3.1) the output list of the main window (see 2.1) can display the answer of a slave or the script in list form depending on how you set this option.

### 3 M-Bus Timeouts

A M-Bus transmission is always a request - answer sequence. The master asks for data or sends a command and the slave has to transmit the requested data or acknowledge the command. For a correct handshake there are some timeouts defined:



- **TA + TO:** TA is a timeout measured in bittimes and is, therefore, baudrate dependend. TO is a timeout measured in milliseconds and is not baudrate depended. The sum of both timeouts is the maximum allowed time between the end of the last stopbit of the outgoing request telegram and the first startbit of the incoming answer telegram. If no answer is received within this time the request is cancelled and a timeout is reported. The default value for TA is 330 bittimes and for TO 50 ms (communicating over a direct connection). However, if the communication is, for example, going over a modem - modem connection TO must be increased to compensate for the additional transmission delay (e.g. TO = 1000..2000 ms).
- **DT:** The deadtime is the time between the end of the last stopbit of the outgoing request telegram and the time after the master is able to receive anything. All bytes received within the deadtime are discarded. The deadtime is used for echo cancelling (some M-Bus repeater and optical transceiver are echoing all bytes). The default value for DT is 11 bittimes.
- **TB:** In M-Bus the end of a telegram is only recognized by a timeout (TB). If there is not another startbit after TB has run out the end of the telegram is recognized. The default value for TB is 1 bittime.

In *M-Bus Application* all timespans are only measured with 1 millisecond precision. This is due to the limitations of the Windows© operating systems. Therefore, and because Windows© is not a real-time operating system (guaranteeing a maximum reaction time) there are some problems arising:

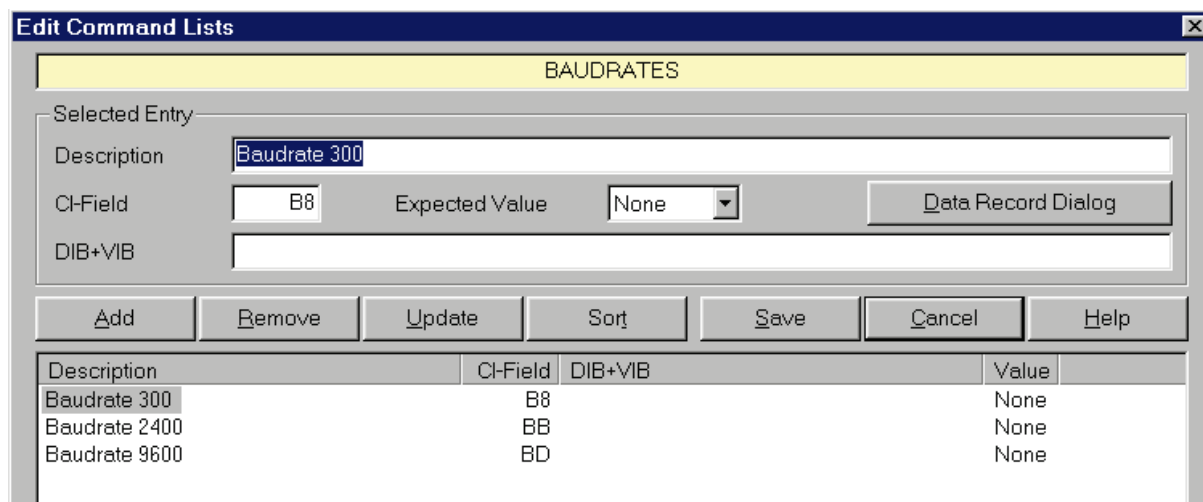
1. TA + TO might be longer than specified.
2. The TB timeout is usually too small to be guaranteed under all circumstances. At higher baudrates TB is significantly smaller than 1 millisecond, however, 1 millisecond is the smallest possible TB time.
3. If you increase DT too much (because the echo is still received in front of the answer telegram) it might work for slaves answering rather slow. However, for slaves answering very quickly the first bytes of the answer telegram could be suppressed.

Another problem arises due to the fact that most serial ports (UARTs) in PC computer systems are buffered. The intention of the so-called FIFO is to buffer more than one received byte, therefore, the operating system does not have to check the serial input too often. However, while using the buffer the time each byte is received is no longer recognized by the operating system and the TB timeout time can not be checked correctly. You have to perform a more relaxed TB timeout checking or switch the FIFO off (to be as close to the M-Bus timeout demands as possible). To switch off the FIFO you have to do the following:

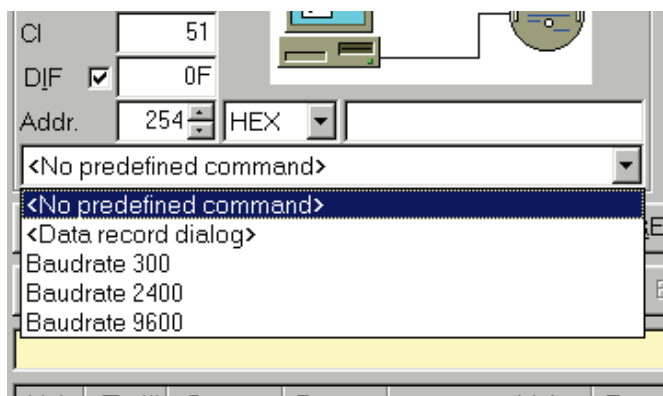
1. From the taskbar choose *START->Settings->Control Panel->System->Devices->COM->Settings ->Extended*
2. Switch off the FIFO buffer using the checkbox or slide the receive and transmit buffer settings to lowest.

## 4 Using M-Bus Command Lists

*M-Bus Command Lists* are useful for predefining master-to-slave commands like standard M-Bus commands (change baudrate) or slave specific commands (clear readout-list, set date and time, ...). Instead of entering all data records in a hexadecimal form the data records are predefined and only the value (if any) is entered before you send the data records to the slave. The following paragraph contains a step-by-step instruction on how to create a *M-Bus Command Lists* with all baudrate-change commands.



1. From the main menu select *Tools->Command Lists*
2. Press *New*
3. Press *Add*
4. Enter the description: 'Baudrate 300'
5. Enter *CI-Field*: 'B8'
6. Clear *DIB + VIB*
7. *Expected Value* is 'None'
8. Press *Update*
9. Press *Add*
10. Enter the description: 'Baudrate 2400'
11. Enter *CI-Field*: 'BB'
12. Clear *DIB + VIB*
13. *Expected Value* is 'None'
14. Press *Update*
15. Repeat step 4 to 8 until all baudrates are entered
16. Press *Save*
17. Enter a unique name (e.g. 'Baudrates')
18. Press *Save*
19. Activate the command list 'Baudrates'
20. Press *OK*
21. Select the baudrate command from the *Command List* of the main window
22. Enter the correct primary address and press *SND\_UD*.



**Remember:** You have to press *Update* if you want to take the changes made.

## 5 Using M-Bus Scripts

*M-Bus Scripts* are useful if you have to send a special command sequence more than once, e.g. selecting and reading out a set of slaves, send a set of parameters to a slave and check if the parameters are correctly taken, .... With *M-Bus Scripts* this can be done with the press of one button. The following paragraph contains a step-by-step instruction on how to create a *M-Bus Script* which selects three slaves (two with standard secondary addressing and one with customer addressing) and reads their meter data.

1. From the main menu select *Tools->M-Bus Scripts*
2. Press *New*
3. Enter the device ID, manufacturer code, generation and medium of the first slave to select
4. Press *Slave Select*
5. Change primary address to 253
6. Press *REQ\_UD2*
7. Enter the device ID, manufacturer code, generation and medium of the second slave to select
8. Press *Slave Select*
9. Change primary address to 253
10. Press *REQ\_UD2*
11. Press the checkbox on the left handside of the device ID once
12. Enter the customer number and address of the slave
13. Press *Slave Select*
14. Change primary address to 253
15. Press *REQ\_UD2*
16. Press *Save*
17. Enter a unique name (e.g. 'SlaveRead')
18. Press *Save*
19. From the list of *M-Bus Scripts* drag 'SlaveRead' to a button of your choice
20. Press *OK*
21. Now you have assigned the *M-Bus Script* 'SlaveRead' to the specified button and you can execute the script by pressing the button.

	Device ID	Man	Ge	Me
<input checked="" type="checkbox"/> Secondary	12345678	4823	00	06

	Number	Address
<input checked="" type="checkbox"/> Custom	398475349759	324020923823

Count	Type	Addr.	Description	Data
1	Select		Standard: 12345678,4823,00,06	
2	REQ_UD2	253		
3	Select		Standard: 87654321,4823,20,07	
4	REQ_UD2	253		
5	Select		Customer: 398475349759,3240...	
6	REQ_UD2	253		

## 6 Questions (Troubleshooting and Hints)

- I am sure that my slave answers correctly but *M-Bus Application* always reports that there is something wrong (timeout, wrong length, startsign or stopsign).
  - Examine the answer closely by using the *Show Buffer* dialog. If the beginning is correct but the end is completely missing there might be a problem with the byte-timeout or the FIFO-buffer setting (TB, see 2.2.3.5, 3). Set the FIFO-buffer to on and set TB to 40 bittimes. If the problem is still present the slave is definitely not working correctly.
  - Examine the answer closely by using the *Show Buffer* dialog. If there are some wrong bytes in front of a correct answer telegram there might be a problem with the deadtime (DT, see 2.2.3.5, 3). Increase the deadtime from 11 bittimes to approximately 15..20 bittimes until the wrong bytes are disappearing. Do not increase the deadtime to much since the first bytes of the correct answer telegram could be suppressed.
  - Examine the answer closely by using the *Show Buffer* dialog. If nothing is received the slave might be too slow for answering within the standard M-Bus timeout time. Increase the timeout (TA or TO, see 2.2.3.5, 3). Please read the troubleshooting hint below if you are using Windows NT© 4.0 Service Pack 3.
- I was able to communicate with my slave but now it is no longer responding.
  - Check if the primary address is still correct. If you, for example, have pressed *Slave Select* or *Slave Search* the primary address is automatically changed to 253.
  - Check if the COM parameters are not changed.
  - Check the cable and the M-Bus repeater
- I am not able to communicate with my slave using an opto-transceiver.
  - Check if the RTS and DTR line settings are correct (see 2.2.3.5). Some opto-transceiver are using these serial port lines for their power supply.
  - Some slaves need an optical synchronisation before you are able to communicate via opto-transceiver (see below).
- My slave needs an optical synchronisation before I am able to communicate via opto-transceiver.
  - A ZVEI opto-sync consists of a two second on-off sequence. The on-off time is usually 417 µs, respectively (one bittime at 2400 baud). You can generate an opto-sync using a M-Bus Script. Insert a *SendHex* line with 240 times 'AA' in the data section (baudrate is 2400). If this is repeated three times (standard retry setting) it is not exactly an opto-sync but it works equally. Usually slaves using this method fell asleep rather quickly after receiving an opto-sync (1 second). Therefore, you may want to insert the action you want to perform (e.g. REQ\_UD2) directly after the opto-sync line into the M-Bus script.
- Using Windows NT© 4.0 Service Pack 3 I recognize 'Timeout Errors' very often, especially with 9600 baud. However, I am very sure that my M-Bus slave is working correctly.
  - The serial device driver of Windows NT© 4.0 is completely different from Windows© 95 / 98. Especially if the UARTs FIFO buffer is switched on it is not guaranteed that the M-Bus telegrams are sent without pauses between two bytes. Therefore, the FIFO buffer should be switched off while using Windows NT© 4.0 (use the serial port settings in the control panel and switch off the checkbox in front of FIFO buffer). In some cases you might also increase TB and decrease DT (see 2.2.3.5, 3).

## 7 Appendices

### 7.1 M-Bus Comand List Format

All *M-Bus Command Lists* are saved in a text file which contains only printable ASCII-characters (except carriage return / line feed). The extension is always *MBL*. If you want to use a command list with *M-Bus Application* it has to be in the installation directory of *M-Bus Application*.

Each command consists of four fields separated by a ‘|’ (7CH / 124D). Therefore, never use a ‘|’ as parameter. At the end of each line is a carriage return and a line feed (CR LF / 0DH 0AH / 13D 10D):

**F1 | F2 | F3 | F4CRLF**

Field 1 (F1) contains the description of the M-Bus command

Field 2 (F2) contains the CI-field (in hexadecimal ASCII format, e.g. 51H is expressed by ‘51’)

Field 3 (F3) contains data (in hexadecimal ASCII format, e.g. 01H 02H is expressed by ‘01 02’)

Field 4 (F4) contains an index of the value type to use with this command. Possible value types are:

Index	Description
N	no value
2	Date and time value
3	Date value
4	1 byte signed integer
5	2 byte signed integer
6	3 byte signed integer
7	4 byte signed integer
8	6 byte signed integer
9	8 byte signed integer
A	2 digit BCD
B	4 digit BCD
C	6 digit BCD
D	8 digit BCD
E	12 digit BCD
F	4 byte real value

Example command list:

```
Comand1 | 51 | 02 13 | 5
DemoCommand | 51 | 84 C0 40 96 0C | 7
DoSomething | 51 | 01 02 | N
```



## 7.2 M-Bus Script File Format

All *M-Bus Scripts* are saved in a text file which contains only printable ASCII-characters (except carriage return / line feed). The extension is always *MBS*. If you want to use a script with *M-Bus Application* it has to be in the installation directory of *M-Bus Application*.

The following table shows the possible M-Bus script lines and an example script. Each script line consists of four fields separated by a '|' (7CH / 124D). Therefore, never use a '|' as parameter. At the end of each line is a carriage return and a line feed (CR LF / 0DH 0AH / 13D 10D):

**F1 | F2 | F3 | F4CRLF**

Field 1 (F1) contains the index of the M-Bus command

Field 2 (F2) contains the primary M-Bus address to use with the command

Field 3 (F3) contains a description

Field 4 (F4) contains data (in hexadecimal ASCII format, e.g. 01H 02H is expressed by '01 02')

F1	F2	F3	F4	Remarks
0	empty	all COM parameters separated by a comma (see example)	empty	Set new COM parameters
1	empty	empty	empty	Start the recording of transmission results
2	empty	empty	empty	Stop the recording of transmission results
3	primary address	empty	empty	SND_NKE to primary address
4	primary address	empty	empty	REQ_UD1 to primary address
5	primary address	empty	empty	REQ_UD2 to primary address
6	empty	empty	empty	Listen only
7	primary address	empty	CI-field, data records	SND_UD to primary address with CI-field (first byte) and following data bytes
8	empty	Standard: DDDDDDDD, MMMM,GG,AA	empty	Slave select with standard secondary addressing (D: device ID, M: manufacturer code, G: generation, A: medium)
9	empty	Customer: NNNNNNNNNNNN, AAAAAAAAAA	empty	Slave select with customer secondary addressing (N: customer number, A: customer address)
10	empty	empty	empty	Primary address slave search
11	empty	empty	empty	Standard secondary addressing slave search
12	empty	empty	empty	Cutomer addressing slave search
13	empty	empty	data bytes	Send HEX (send data bytes without any M-Bus telegram frame)
14	empty	time in 100 ms (1/10 second)	empty	Delay script execution
15	empty	1 = next full minute 2 = next full two minutes 5 = next full five minutes 10 = next full ten minutes 15 = next full fifteen minutes 20 = next full twenty minutes 30 = next full thirty minutes 60 = next full hour 120 = next full two hours 180 = next full three hours 240 = next full four hours 360 = next full six hours 720 = next full twelve hours 1440 = next full day	empty	Wait until the condition is met (based on computer system time)

Example script containing all possible M-Bus script lines:

```
0||COM2,300,8,1,E,RTS_Reset,DTR_Reset,TA=330,TO=50,TB=4,PartWait,Retries=3,DT=11,HS=0|
1|||
2|||
3|254||
4|254||
5|254||
6|||
7|254||51 01 02
8||Standard: FFFFFFFF,FFFF,FF,FF|
9||Customer: FFFFFFFFFF,FFFFFFFFFFFF|
10|||
11|||
12|||
13|||01 02
14||5|
15||1|
```

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## Version History:

- 1.00: Initial release
- 1.01: Slave search bug fixed (if a slave has answered a selection telegram with a long telegram instead of E5H, the slave search has stoped)
- 1.02: Windows NT timing bugs fixed (echo canceling time) / Cursor problems fixed (question mark cusor never changed back to arrow)
- 1.03: Windows NT timing bugs also fixed for 'ListenOnly'
- 1.04: M-Bus option 'Only VIFs without multiplier' added (see 2.2.3.2)
- 1.05: M-Bus VIF table corrected (variable protocol ; VIF = 08H..0FH)  
DIF with variable length added (DIF = 0DH)  
Column 'RC' (retry count) added between 'request / answer' and 'date' in data export file  
Script bug fixed (if a script line with special address 256, 257 or 258 was inserted immediatly behind another script line with special address the script was not executed correctly)
- 1.06: M-Bus option 'Slave Search CI-Field' added (see 2.2.3.2)  
Bug in secondary address slave search corrected
- 1.07: If a collision appears during a secondary-address slavesearch a 100 ms delay is inserted in front of the next request.
- 1.08: M-Bus slave mode added.  
The fabrication number is now correctly inserted into the slave list if the RSP\_UD answer of the slave contains a datarecord with the fabrication number.
- 1.10: Remote connection (modem) support added.  
Minor bug in 'Edit Script' dialog fixed.
- 1.11: MSB and LSB were mixed up during slave select in M-Bus slave mode  
VIF values without multiplier contained a bug when receiving a BCD value
- 1.12: Implementation of HEX-characters in BCD-values as proposed by the M-Bus working group (Note: combination of HEX-characters (0xDx) are not supported).
- 1.13: Implementation of CPU-Repeater Mode and CPU-Repeater slave list functions  
Calculations dialog now contains DES encryption / decryption (ECB and CBC modes)  
Automatic DES data decryption for certain meter types  
Fix mode data bug fixed, if VIF units without multiplier was selected the value in fix mode telegrams was correctly calculated but the VIF unit was not set accorodngly.  
Slave search funcion corrected so that manufacturer, generation and medium run from 0..F and only the device ID runs from 0..9. Previously all fields were running from 0..9.
- 1.14: If a slave has answered with a string VIF (=7C) the value was sometimes misinterpreted as date / time value even though it was a 2 or 4 byte integer. This bug is fixed.

- 1.15: Using the edit command list dialog it was not possible to enter an empty DIB+VIB field. After saving the CI-field was copied to the empty DIB+VIB field. This bug is fixed.  
The 'AT' commands to initiate and cancel a phone connection are no longer sent with carriage return + line feed (ODH 0AH) but only with a carriage return (ODH).
- 1.16: A minor bug in the slave search algorithm was fixed.
- 1.17: New media according to prEN13757-3 are implemented.  
Non-metric units according to prEN13757-3 are implemented (VIFE 3DH).  
If a telegram contains VIFE 39H the value will now be interpreted as Date+Time.  
The selection ASC (for text) is now available for entries of a command list.  
If a date contains the flags "every day", "every month", or "every year" the respective value within the date is replaced by "--".
- 1.18: Bug in Datarecord dialog value entry fixed (for BCD values the entry was MSB first, now corrected to LSB first).
- 1.19: PRIOS radio device decryption support added.
- 1.20: New VIF units according to prEN 13757-3 (2003-4) added.
- 1.21: Calculation of M-Bus date data types F and G in dialog "Calculations" added.
- 1.22: The CI fields 0x7A (RSP\_UD with 4 byte header) and 0x78 (RSP\_UD without Header) are now also interpreted.  
The one byte answer 0xA2 (NAK = not acknowledged) is now also recognised.
- 1.23: The VIF = 0x7C (VIF in following string) may now be interpreted in two different ways. The user may choose one of the two interpretations by selecting the option in the options dialog. Standard interpretation is: VIF VIFE AsciiUnit, the alternate interpretation is VIF AsciiUnit VIFE.
- 1.24: AES 128 telegram decryption added
- 1.25: M-Bus time format type J interpretation added.
- 1.26: NIST AES key wrapping added.
- 1.27: Direct log file writing to a file added. Automatic current date inserting added.
- 1.28: New M-Bus media (device types, 0x20..0x3F) added.  
CI-fields 0x70, 0x71 and 0x7F added.
- 1.29: VIFE table 0xFC added